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EDITORIAL

Encouragement of Crop Production.

In periods of abnormal trade conditions, such as exist at the present time, attention is directed to the possibility of a nation maintaining to a reasonable degree its standard of living by the production particularly of its own food requirements.

Whereas conditions in years of normal trade encourage nations to produce goods for which they are adapted in exchange for necessities of life from other countries this system entails considerable hardship during periods of trade depression.

We have past and present experience in Malaya of the hardship entailed on the peasantry by the lack of adequate local food production in periods when either imported food is restricted in quantity or dear, or when our main export products are unprofitable to the producer.

Already much attention has been given locally to the task of increasing the Malayan production of rice so that the country may be less reliant on external sources of supply. Steps have now been taken to improve matters in this direction, and the recently formed Department of Irrigation and Drainage constitutes a distinct advance in this direction.

While this problem engages our attention, it is fruitful to consider the efforts made to solve somewhat similar problems in other countries, and in this connection our attention is drawn to a revised edition of a statement issued by the Italian Ministry of Agriculture and Forests, General Direction of Agriculture on "The Wheat Campaign in Italy", initiated by the Italian Premier, His Excellency Benito Mussolini.

The subject is only indirectly related to the rice industry in Malaya, but is of interest both in relation to the development of agricultural policy and also as representing a large scale effort to increase the yield of a cereal crop.

The Italian campaign aims at increasing the production of wheat in Italy. Wheat is the staple food of Italians and the local demand is considered more likely to increase than otherwise.

The production of wheat in Italy up to 1925 only sufficed to meet about two-thirds of the total consumption, the remainder being imported. Moreover, compared with the countries of Northern Europe, the yields per hectare were low

although the total area cultivated was greater, being the second largest in Europe and the fifth largest of any country in the world.

It was considered that dependence of the country on foreign sources of supply was dangerous, particularly in view of Italy's strategic position; the campaign aims at lessening this and is regarded as a part of the Fascist agrarian policy for the Ruralisation of Italy.

The lines along which the campaign has been conceived aim at increasing the yield per hectare rather than extending the cultivated area. It is considered that, as the greater part of the cultivable land in Italy is already under cultivation it is not desirable to replace with wheat other crops which may be more profitable and which in any case are an essential part of the national economy, and that if yields could be raised, the area planted under wheat in 1924 should suffice to meet requirements.

To carry out the campaign, the National Wheat Committee was formed under the presidency of the Head of the Government, the Vice-President being the Minister of Agriculture and Forests. The number of members of the Committee is now eighteen of whom eleven are technical experts.

Under this National Committee, provincial commissions have been appointed, one for each of the 92 provinces in Italy.

The policy of the compaign comprises; firstly, general measures applicable to the whole community and secondly, local measures applicable to particular regions.

The general scope of the measures undertaken has been as follows:— research and investigation; instructional and propagandist; the provision of direct assistance to farmers; financial assistance and fiscal measures.

The provincial commissions indicate and define the essential lines of local technical and economic work and the policy to be adopted having regard to local conditions. They also apply and administer the approved provisions for carrying out such work.

The principal directions in which efforts have been undertaken include the strengthening of the local agricultural organisations by increasing staff and improving facilities; enlisting the active support of the movement by various agricultural bodies and by the establishment of experiment and demonstration plots on a large scale, about 35,000 having been established, combined with the extended organisation of research into all questions connected with the agricultural and economic aspects of the crop.

Efforts have also been directed to the organisation of propaganda on a large scale; the institution of wheat competitions; the reorganisation and extension of the provision of agricultural credit; assistance and encouragement in the use of better agricultural machinery and the extended use of fertilisers; and fiscal policy of the industry by raising the import duties on wheat. Concurrently, provision has been made for the raising and distribution on a large scale of improved and selected strains of seed.

In spite of adverse economic conditions, the wheat campaign has been sustained, the expenditure on agricultural services having been doubled since 1922, while on the wheat campaign a total sum of 225 million lira has been expended in the four years to 1930.

It seems too early to pronounce an opinion as to what extent the aims of the movement will ultimately be fulfilled, but as compared with the pre-war period 1909—13, the returns of wheat per hectare for the years 1926—30 show a distinct increase, the average yield per hectare for the whole of Italy being for the latter period 12.44 quintals as against 10.5 for the former, while there has been some increase in the area cultivated. In addition, there has been a marked decrease in the imports of wheat into Italy.

The parallel of wheat production in Italy and rice in Malaya is evident, and it is probable that other countries will find similar comparisons with their staple foodstuffs instructive. The Italian agricultural policy aims at awakening the agricultural conscience of the native and imparting a stimulus to the solution of the agricultural problem and the accomplishment of agricultural reforms, with the object of rendering the country not only self-sufficient agriculturally, but capable of developing its export trades. It is an experiment that has our sympathy and we shall follow its development with interest and profit.

Local Manuring. Some attention has been directed of late to the possibility of the extended use of fertilisers in Malayan Agriculture. Speaking generally, it has been found that rubber grown on virgin land and with adequate precautions for soil retention should not require manuring except perhaps in exceptional cases and at comparatively long intervals.

The manuring of the more important of Malayan crops is not very general, but it is probable that as time goes on and the knowledge of the manurial requirements of such crops becomes more understood, scientific manuring will play a more important part in local agricultural practice.

An outline is given in an article in this number of the experiments devised and commenced in Malaya by the Department of Agriculture with the object of making available more exact knowledge concerning the manurial requirements of coconuts and oil palms.

It is pointed out that it is desirable that estates themselves should carry out experiments on manuring, but for this purpose the "lay-out" described is considered too intricate and it is recommended that in such cases larger plots should be demarcated.

The Department of Agriculture has made some enquiry regarding the local sources of fertiliser material, the result of which is stated in an article in this number. It will be seen that the local resources are extremely limited, consisting chiefly of bat guano which, outside Perlis, is available in such uncertain quantities that its export from the particular States in which it is found is generally prohibited. The only other source is fish refuse and bones. Both of them, being by-products of a local industry in one case and of local food supply in the other,

are necessarily restricted in quantity. It would seem that the future must largely depend for its fertilisers on imports and it therefore becomes doubly imperative that agricultural practice in Malaya should aim at conserving the inherent fertility of the soils. Wastage in the past has consisted chiefly of bad soil conservation and wastage of organic matter. Future policy should aim at retaining soil fertility by natural means rather than early recourse to artificial fertilisers.

Observations on Coconuts.

The early history of many of the coconut estates in Malaya is not known or is shrouded in doubt. The chequered history of many precludes the possibility of judging today the ultimate effect on crops of cultural and other policies adopted in the past.

Fortunately, however, a few estates exist which possess complete histories of individual fields. The observations of a manager of such an estate are recorded in an article by Mr. A. C. Smith entitled "Observations on Coconut Crops" which will be found on another page. The author, a practical planter, concludes from the records of the estate of which he is manager, that on alluvial soil an estate should be self-supporting in its eighth year, by which time the crop should be about 5 piculs of copra per acre per annum. Maturity should be reached in the twelfth year from planting and profitable yields should thereafter be obtained for at least 30 years.

Original Articles.

EXPERIMENTS ON THE MANURING OF COCONUTS AND OIL PALMS *

One of the striking features of agriculture in Malaya is the remarkably small quantity of fertilisers, natural or artificial, employed for the major crops, rubber, coconuts, rice and oil palms. The manuring of rubber is receiving attention by the Rubber Research Institute, that of rice has been the subject of experiment by this department for a number of years. In this article it is proposed to give an account of the experiments in progress with coconuts and oil palms, leaving to a future date the statistical treatment of results and justification of the lay-out adopted.

There is increasing recognition of the difficulty of securing accurate and and generally applicable information on the response of permanent crops to manuring or to cultivation, owing to the large variation inherent in such crops due in part to the use of unselected material. There are further difficulties in dealing with coconuts and oil palms due to the bulk and weight of the crops, to wide planting (50—55 trees per acre) and to the fact that an all the year round harvest greatly increases difficulties of supervision and recording. The factor of permanence which might appear to favour accuracy does not really do so since the relative yields of individual trees do not necessarily remain constant from year to year with sufficient exactness to enable any great reliance to be placed on preliminary records.

Coconuts.

Considering the lengthy period of coconut cultivation in the tropics, the absence of reliable experiments on the effects of manuring and cultivation is truly surprising; in addition, the few recorded experiments refer to coconuts growing on soils which are considerably lighter in texture than those on which the palms are commonly found in Malaya. It is doubtless due to this factor that, as a rule, manuring is conspicuously absent from local practice, our heavy coastal soils being much richer in plant nutrients than, for example, the light coconut soils of Ceylon.

The Economic Botanist of this Department (Dr. H. W. Jack) has for some years carried out manurial experiments on one estate and publication of the results will be made in the near future; it was, however, felt that to obtain generally useful results more widely distributed experiments were necessary and the opportunity was taken of combining with manurial treatments investigations of the effect of a cover and of cultivation. The difficulties connected with recording have been mentioned. With the best good will it is not a fair charge on managers of estates to expect from them the careful supervision which is

* Compiled from Departmental Records.

DIAGRAM A.

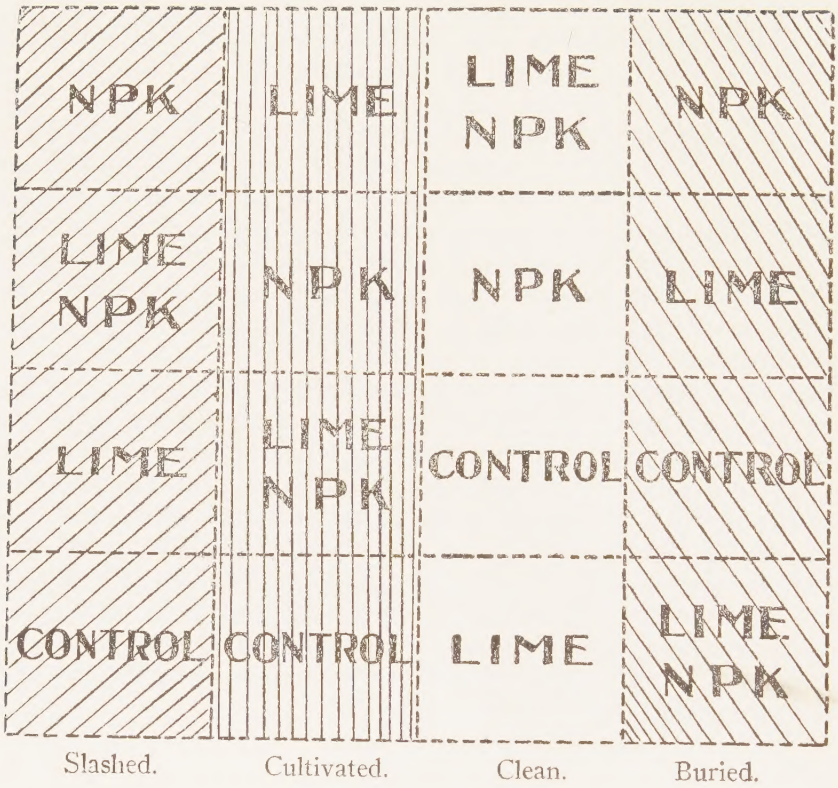
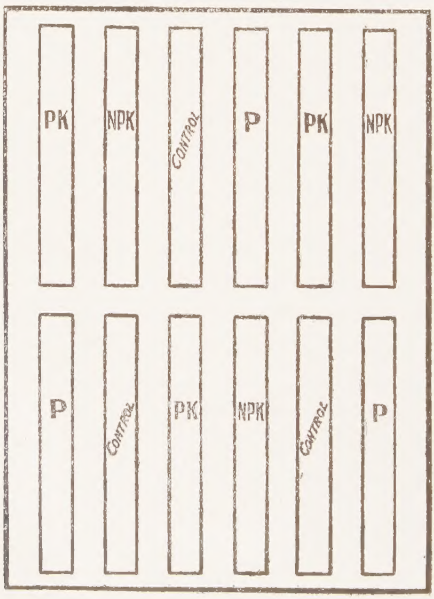


DIAGRAM B.



absolutely essential if results are to be of value; on the other hand, experimentation with large areas scattered about the country would involve an excessive strain on the personnel of the Department of Agriculture; the number of trees employed must, therefore, be kept down to the minimum requisite for the desired accuracy. Happily, recent advances in the application of statistical methods to agricultural experiments have provided methods of combining results from all of the treatments in any experiment and of analysing variation encountered into its component parts which enable the best use to be made of a limited number of trees.

After discussion by the Departmental Copra and Oil Palm Committee the following standardised lay-out was adopted on each of seven estates; four blocks were selected in different parts of the estate but on the same soil type and bearing trees of the same age. Each block was divided into 4 plots carrying 26 trees in two rows, while each plot was sub-divided into 4 sub-plots of 4 experimental trees separated by guard trees. The plots run parallel to drains which were dug where necessary. On each plot a different type of surface treatment was adopted. These were (1) grass or leguminous cover (whichever was growing on the areas selected) slashed every three months and allowed to lie on the surface, (2) grass or cover turned in to a depth of 7 inches every six months, (3) clean weeded, (4) clean weeded and cultivated to a depth of 7 inches yearly. Each treatment is thus repeated 4 times and is tested on 64 trees.

There are three manurial treatments and one control on the 4 sub-plots on each plot, namely complete fertiliser, lime plus complete fertiliser and lime alone. Each treatment is therefore repeated 16 times and on 64 trees. There is also the possibility of testing the effect of cultivation on manurial treatments and *vice versa*. Diagram A shows the lay-out of one block.

The complete fertiliser employed is made up as follows:—

Whale Guano Compound	...	2½ lbs. per tree
Steamed Bone Meal	...	4 lbs. per tree
Muriate of Potash	...	1½ lbs. per tree.

This mixture supplies Nitrogen (N) 12, (Phosphoric acid) P_2O_5 44, Potash (K_2O) 36 lbs. per acre.

Lime is supplied at the rate of 10 piculs (approx. 12 cwts.) per acre. Applications are made once a year, the manures being broadcasted.

Blocks are demarcated by wire fences and the trees of sub-plots are marked by means of different colour paints.

Demarcations and applications of manures are made by an Assistant Agriculturist and records of nuts are made by a Malay Officer of the Agricultural Division whose work is checked by surprise visits from Agricultural Field Officers.

The plots are harvested monthly by coolies who are trained to the work, all nuts approaching ripeness being picked, therefore there is practically no nut-fall between each picking. The error likely to occur if nuts were allowed to fall and roll into adjoining plots is thus avoided.

The harvesting coolies work under the supervision of the Malay Officer, who records the yields. Two coolies with knives on long bamboo poles are employed to pick the nuts and two coolies, one watching each of the pickers, to collect the nuts into heaps in the plots from which they are picked. The Malay Officer then records the number of nuts in a Field Book provided for the purpose, a separate account of bad and damaged nuts being kept.

The standardised experiments have been laid out with the cordial co-operation of Agents and Managers on estates distributed as follows :—

Estate	Locality	Age of Palms	Type of Soil	Date of 1st Application of Manures.	
A	Banting	21 yrs.	Alluvial Clay Loam	Lime applied	11.7.30
				Manure „	31.7.30
B	Province Wellesley North	Unknown very old	Sandy soil over white silt	Lime „	5.1.31
				Manure „	9.2.31
C	Province Wellesley South	20 yrs.	Heavy clay	Lime „	4.3.31
				Manure „	24.3.31
D	Krian District	20 yrs.	Friable clay Loam	Lime „	6.1.31
				Manure „	20.2.31
E	Bagan Datoh	20 yrs.	Heavy clay	Lime „	8.1.31
				Manure „	12.2.31
F	Sabak Bernam	17 yrs.	Very heavy clay	Lime „	9.1.31
				Manure „	13.2.31
G	Sepang	10—11 years.	Peat overlying heavy clay	Lime „	26.1.31
				Manure „	23.2.31

Yield records are at present taken only of numbers of nuts, and as anticipated, in view of the long maturation period of the nuts no effects of cultural or manurial treatment have yet been found. On Estate B with the lightest and poorest soil and trees there is improvement in appearance and in numbers of young nuts carried on the trees.

Statistical treatment of the results from estates of the first year's manuring has shown that increases of 10 to 15 per cent. over controls for manurial treatment and of 15 to 22 per cent. for cultural treatment would be "significant" and that soil variation is small in comparison with variation from tree to tree.

As the experiment progresses it will be necessary to devise some practical means of recording the possible effect of copra per nut and this difficult question is receiving attention. The obvious solution of drying the nuts from each subplot separately would throw an undue strain on the management and might, as a result of mixing in the kiln, lead to erroneous results.

There are three obvious criticisms which may be made of the experiments described—

(1) That only one manurial mixture is under observation.

(2) That leguminous covers are only being tested on two estates and that grass is frequently said to have a toxic effect.

(3) That the very important question of manuring of young coconuts is left untouched.

The answers to these criticisms are—

(1) Staff and time are limited and it was therefore decided that a complete mixture should first be tried in order to ascertain whether on the generally heavy coastal soils of Malaya *any* response is obtained from manuring. If a response is found, subsequent various less complete mixtures or simple manures will be tried.

(2) Limitation of staff and time again rendered it desirable to concentrate on the cover for the present growing on the estates.

(3) It had been decided to carry out experiments on manuring of young coconuts on the contemplated extension at Klang Coconut Experimental Station. Unfortunately, the present need for economy has led to the postponement of this extension and of the contemplated experiments.

Oil Palms.

Unlike coconuts, oil palms are found in Malaya chiefly on inland soils which are frequently poor in nutrients, and in view of the considerable demands made by the crop, response to manuring is more likely to be attained than is the case with coconuts.

Unfortunately, owing to the necessity of weekly instead of monthly records, experiments are still more difficult to arrange. In addition, variability is nearly twice as great as that found in coconuts.

Three lots of manurial experiments have been laid out as follows :—

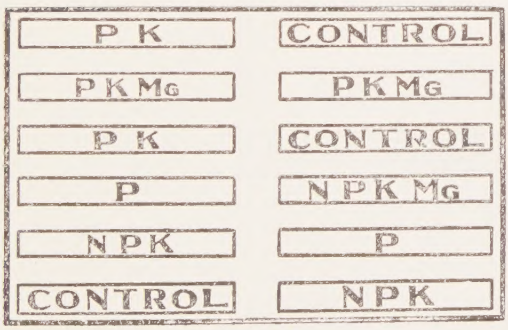
(1) Experimental Plantation, Serdang, on palms 8 years old on a quartzite valley soil.

(2) Estate A On palms 7½ to 8 years of age quartzite hillside soil.

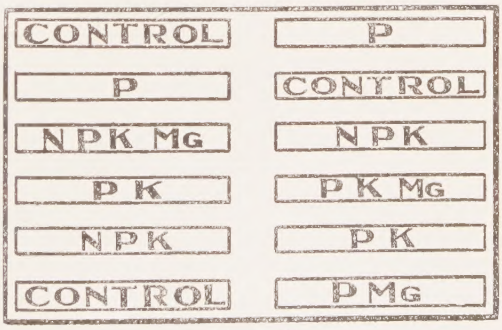
(3) Estate B On palms 9 years of age on (a) poor sandy, (b) organic soil.

Manures were first applied to the Serdang plots on 30th August, 1930 and to Estates A and B on 18th and 21st July, 1930, respectively. Preliminary records were made for one and a half years.

DIAGRAM C.

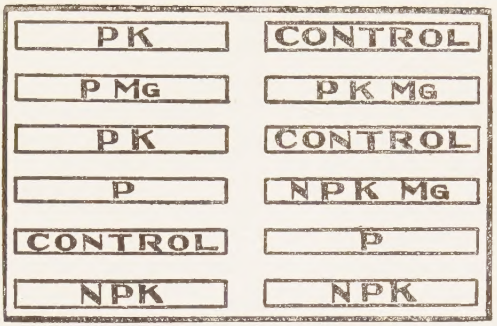


Block A.

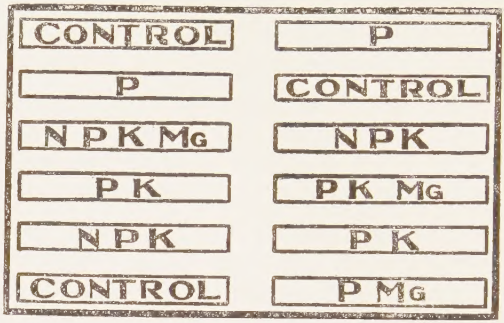


Block B.

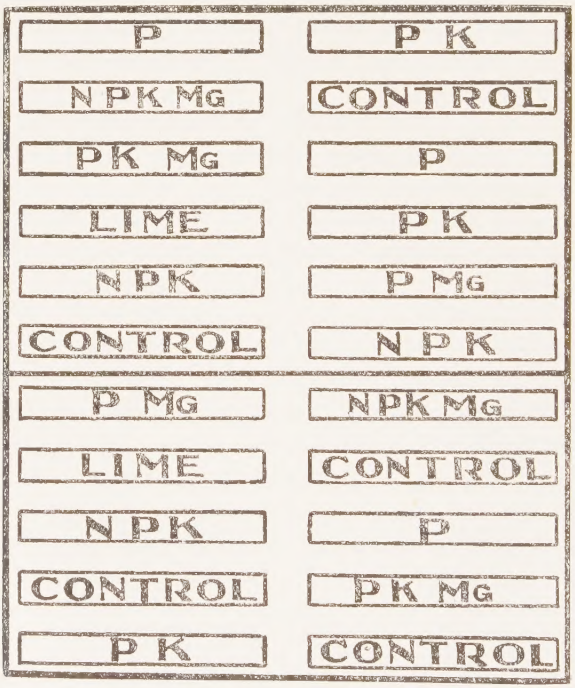
DIAGRAM D.



Block A.



Block C.



Block B.

The treatments and lay-out at Serdang are as follows—

Twelve plots of 10 palms each are laid out in one block as per diagram E (which has already been published in the Guide to the Experimental Plantation, Serdang, facing p. 28).

The manurial treatments are in triplicate as follows :—

3 plots Nitrogen, Phosphate and Potash
3 plots Phosphate and Potash
3 plots Phosphate
3 plots Controls (untreated).

The method of application is the same as described for the experimental plots on Estates A and B.

The lay-out on Estates A and B is shown in diagrams C and D, plots consist of 10 trees each with guard rows.

The treatments are as follows :—

Sulphate of Ammonia (20 per cent.) at the rate of 1 lb. per palm.
Supherphosphate (18/20 per cent. P_2O_5)at the rate of 3 lbs. per palm.
Sulphate of Potash (50 per cent. K_2O) at the rate of 1 lb. per palm.
Sulphate of Magnesia (16 per cent. MgO) at the rate of $1\frac{1}{2}$ lbs. per palm.

These were supplied in various combinations every six months supplying Nitrogen, Phosphate, Potash and Magnesium respectively as indicated on the plan showing the lay-out.

Before the application of the manure the plots were dug over leaving the soil rough.

The various mixtures were prepared and put into suitable sized bags to ensure even distribution of the manures over the plots. The mixtures were spread by hand, the application extending to the guard rows on either side of the plots. The manures were then stirred into the soil by coolies breaking down the rough surface soil.

On Estate B blocks B and D two plots were treated with freshly burnt lime at the rate of 10 piculs per acre (approx. 12 cwts. per acre).

On Estate A the experiment plots are laid out on the gentle slopes of hillsides and each palm has had a silt pit dug on its lower side, the soil from this source being used to make a platform round each palm. On this estate, Blocks A and B are given the same treatment as A and C respectively on Estate B except that in Block A on Estate A owing to an error when making the first application the control plot 9 has changed places with NPK plot 12.

For 1932 as a result of pot culture experiments made in another connection the phosphatic manure has been changed to basic slag supplying the same quantity of phosphorus.

Examination of the preliminary yield records show that as in coconuts, soil variation is small compared with tree variation and that increases of 20—30 per cent. over the control would be necessary for significance. This figure, although high, represents approximately the increase necessary to repay manuring with a complete mixture. It should be realised that should the experiments proceed

according to plan the increase necessary for significance will become smaller as the experiment proceeds.

During 1932 a further series of simple experiments will be started at Serdang on nine year old palms growing on high level quartzite soils in Block 5D as follows :—

The whole area is to be divided into four equal plots and the scheme of manuring is to be as follows :—

One plot Rock Phosphate 23 per cent. P_2O_5	...	6 lbs. per palm
Kainit (double) 20 per cent. K_2O	...	4 „ „ „
Total	...	10 „ „ „
One plot Basic Slag 16 per cent. P_2O_5	...	8 lbs. per palm
Kainit (double) 20 per cent. K_2O	...	4 „ „ „
Total	...	12 „ „ „

Two plots controls. (untreated)

The manures will be applied yearly to alternate rows of palms so that the whole area in the treated plots will receive a dressing of manure every two years.

Yield records of all these palms have been taken since 1926.

Experimentations on Plantations.

It is probable and desirable that those responsible for the direction of estates will wish to experiment for themselves especially if positive results or indications of positive results are obtained from the experiments here described. It is not considered that a lay-out with a large number of small plots is suited to estate conditions and unless a special worker can be detailed, is likely to prove too complicated.

There are definite statistical and other advantages in a number of small plots, but owing to the relatively small importance of soil variations quite good results can be expected from a smaller number of larger plots say of one acre each. It is suggested that three one-acre plots per treatment would give significant increases of 15—20 per cent. for coconuts and of 20—30 per cent. for oil palms. It would be advisable to take preliminary yields for one year of a number of adjacent one-acre plots and to select those giving most nearly equal yields.

Summary.

A description is given of Departmental experiments in progress on coconuts and oil palms and suggestions are made for simple experiments suitable for estates.

LOCAL FERTILISERS AND THEIR USES.

Compiled from information supplied by the Field Branch of the Department of Agriculture.

Information on the subject of local fertiliser materials, their preparation, sale and present uses has hitherto been scattered. The following article deals with the more important of such products and may lead to a true appreciation of their usefulness.

Phosphates of Lime.

It must not be forgotten that Christmas Island is part of Malaya and is the centre of an important trade in the rock phosphates that are mined in that Island. These phosphates of lime are exported and are principally employed in the manufacture of superphosphate. The export in 1930 was nearly 120,000 tons, valued at over $2,000,000. This material is exported direct, mostly to Japan and Australia and is therefore only of passing interest in this place.

Guano.

In several parts of Malaya, notably in Perlis, near Ipoh in Perak and near Kuala Lumpur, bat guano deposits occur in caves in limestone hills. The largest deposits which are worked are situated in Perlis, but considerable quantities are obtained in the Districts of Kota Star, Kubang Pasu, Baling and Langkawi in the State of Kedah, although the available supply in that State is limited in quantity.

The Perlis deposits have been used by the local padi planters and others for many years. The caves have been exploited commercially from time to time, and a trade still exists in this product.

Perlis guano is not only frequently used in that State, but is exported. It is on sale in Kedah and in most Districts of Province Wellesley and Penang. The usual price paid by padi planters in the Province is 30 cents for 4 gantangs.

In the case of the Kedah supplies, the Government collects a royalty of 5 cents per picul from dealers, but Malay padi planters are allowed to take supplies for their own irrigated padi lands free of charge. It is, therefore, not possible to ascertain the quantity of guano collected and used each year. The export of guano from Kedah is prohibited.

The prices charged by dealers for different grades from Kota Star and Kubang Pasu at the present time are :—

Grade I, used for dipping purposes $6 for 400 gantangs.
Grade II for broadcasting $3 to $5 for 400 gantangs.
Grade III for broadcasting $2 to $4 for 400 gantangs.

The weight per gantang varies from 7 lbs. to 9 lbs.

The Balang guano is sold for 15 cents per picul.

Guano from the caves of Kedah and Perlis varies considerably in physical

and chemical characters, even when obtained from one cave. Its colour ranges from dark chocolate to light brown. The rough classification stated above is based on odour, colour and feel.

As a rule, higher prices are charged for dark-coloured grades, which are probably newer deposits and contain a higher percentage of nitrogen than the lighter-coloured grades.

There was until recently an import of guano to Penang from Siam. This trade has now ceased as the Siam Government has forbidden its export.

There is now a small export trade in guano from Malaya. The net export in 1930 amounted to 584 tons valued at $44,465.

Guano in Padi Cultivation.

Guano is the manure chiefly used in padi cultivation, especially in Kedah and Perlis, and to a less extent in Province Wellesley. Malay cultivators have two methods of using this fertiliser, *viz*: a dipping method and a broadcasting method.

Dipping Method.—About 44 days after sowing the padi seed in nurseries the young plants are pulled up by hand and the earth adhering to their roots is removed by striking sharply the bases of the seedlings against the side of an uplifted foot. The plants are then tied together in bundles and allowed to drain. These operations are usually performed in the morning so that the plants can be partially dried, and made ready for dipping in the manure in the afternoon of the same day.

Prior to pulling up the seedlings a small hole is dug in the ground in a dry place near to the nursery and in this is placed a supply of guano. A dark coloured guano which adheres well to the roots when wet is preferred. The guano would probably contain 17 to 25 per cent., phosphoric acid, but very little nitrogen. Water is mixed with the guano in sufficient quantity to make a soft paste, in this the bundles of plants are dipped. As each bundle is immersed in the paste it is sharply twisted and turned so that the roots and lower part of the stem of each plant may receive a thin coating of the manure.

After being dipped, the bundles are stacked in large heaps in a shady place, with all the roots facing one way, and covered with straw-mats, or grass. The heaps are not disturbed for two nights and during this period a number of adventitious roots are pushed out from the short, thick stem of the crown just above the root-zone. The first formed, or original roots, are nearly all destroyed in the uprooting operation so that it is these new roots, which after 2 nights only in the heaps may measure up to ½ inch long and are thickly covered with root-hairs, that are able to take up any plant food supplied by the manure immediately after planting.

After remaining in heaps for the period indicated, the bundles are transported to the field. Before planting, the leaves are pruned back severely to reduce transpiration, but as a result of the very severe injury to the roots most of the outer leaves become dry and decay and the inner younger ones only con-

tinue to develop. A few days after transplanting, however, the short submerged stem lengthens considerably to a point just below the level of the soil. The length of this extension of the stem depends largely on the depth of planting, but it is usually 2 to 3 inches long. The plant then forms a new and larger crown with a mass of roots and rootlets and it is from this new crown that most of the subsequent development of the plant proceeds. The original root-system is, therefore, of secondary importance after the development of the second crown which, as has been shown, is formed as a result of the transplanting operation. It has been thought necessary to describe briefly here the young wet-padi plant in order to show that under local conditions the first-formed roots to which manure is applied take little part in the absorption of food after the plant has been removed from the nursery.

Whilst the object of the direct application of the guano is to enable the padi plant to obtain quickly and readily small supplies of phosphoric acid, it is doubtful whether in many cases the results obtained are worth while, even considering the small cost of the manure and labour, because the quality of the manure varies so much. Again, only small quantities are applied by this method. At the Telok Chengai Station, for example, where 35 bundles of plants were sufficient to plant one relong (¾ acre), the amount of guano used was about 10 gantangs, say 80 lbs. containing by analysis 17 per cent., phosphoric acid, that is approximately 14 lbs. of phosphoric acid, only, per relong. The cost of the manure was 5 cents per gantang or 50 cents per relong.

The Broadcasting Method.—This consists of broadcasting the guano before, or soon after, planting at the rate of 80 to 100 gantangs (640—800 lbs.) per relong. The dressing is applied once in 3 years. The lighter-coloured guanos are usually selected for this purpose, and like those used for dipping purposes, their values, based on the manurial constituents they contain, are not known, so that the results obtained may, or may not, be satisfactory. The cost of the manure and labour is about $5.40 per relong, or $1.80 per annum. On suitable soils the increased yields due to manuring with a good grade of manure are said to be about 80 gantangs of padi the first year, 60 gantangs the second and 30 gantangs the third year, or a total of 170 gantangs, which valued at 7 cents per gantang, equals $11.90 or a total profit of $6.50 per relong spread over a period of three seasons.

The manurial experiments with guano of known composition now in progress at the Telok Chengai Experiment Station will, it is hoped, supply useful information as to the value of the local guano as a manure for wet padi when used either for dipping or broadcasting purposes. Even with such information available, the difficulty of evaluating the different grades, based on the amount of available plant food they contain, will still remain unless arrangements can be made for systematic analyses of the supplies sold to padi planters and others.

Dried Fish and Prawn Waste.

The trade in fish and prawn waste to be used as a fertiliser is of some im-

portance, especially in Province Wellesley and Penang.

The official figures compiled by the Trade and Customs Department shew that in 1930, the import of "Bones and Fish for Manure" amounted to 5,728 tons, valued at $323,989. The figures for years previous to 1930 referred to "Bones for Manure", no mention being made of fish for this purpose. The export of bones was then about 500 tons per annum, so that it would seem that Malaya, in addition to producing fish manure, also imports this commodity to the extent of about 5,000 tons annually.

The preparation of dried fish and prawn waste is fairly extensively carried out in most districts of Province Wellesley and Penang on account of the nearness to the sea and comparatively large fishing population.

The method of preparation in the various Districts is as follows :—

Prawns are brought in to Penang Island by the fishermen and boiled for about an hour. Salt is then added at the rate of about 5 kati* to one picul of prawns (5 per cent.). After mixing, the product is sun-dried. On the completion of drying, it is placed in a bag and beaten on a mat for about 10 minutes. It is then sifted, the prawns that remain on the sieve being used for edible purposes, while the siftings are collected and sold as food for ducks or as a fertiliser.

From one picul of prawns treated, about 30 kati of dust and waste are obtained. The waste is sold for about $2.50 per picul to local spice or fruit growers, or to dealers in Georgetown.

The chief centres of the industry are at Kuala Jalan Bharu, Kuala Sungei Pinang, Pasir Panjang, Pantai Acheh and Gertak Sanggol.

In the North District of Province Wellesley, the small fishes brought in by local fishermen are separated from those of marketable size and are placed in tubs with a quantity of salt ,where they remain for 2 or 3 days after which they are sun-dried. This dried fish waste is sold for $2 per picul, but is only used in small quantities as a fertiliser, the greater part being used as a pig food.

No prawn or fish waste is made in the Central District of Province Wellesley, but prawn waste is imported from Kuala Kurau, Perak, and is extensively used by Chinese market gardeners who pay $3 per picul for dried fish and $3.50 per picul for prawn waste.

In the South District of Province Wellesley, the unsold fish and prawns from local markets which are unfit for salting or feeding to pigs, are sold to market gardeners at 1 or 2 cents per kati. The gardener places this material in a tub, seals it up with mud and allows it to ferment for three weeks. When well decomposed it is used as a fertiliser.

In the Dindings, prawns, when plentiful, are boiled with a small quantity of salt, dried for 1 or 2 days and sold to water-melon growers at 4-5 cents per kati.

Prawn and fish waste is prepared in other parts of the country generally

*1 picul = 100 kati = 133⅓ lbs.

to utilise the unwanted fish when the market is overstocked. Such material is used as a pig and poultry food if sufficiently good, otherwise it commands a ready sale as a fertiliser.

Bones.

The Malayan trade results in a small net export of bones, but in addition, the use of bones as a fertiliser is appreciated both by the Chinese and Malays, the former in connection with vegetable and fruit growing, the latter in padi cultivation.

In Singapore, bones from slaughter houses are generally purchased by hawkers for the preparation of soups. A small proportion of the bones so treated are crushed and used as a fertiliser.

It is recorded that bones from the slaughter houses of the North District of Province Wellesley are accumulated and sold, mostly to Malays from Malacca, at rates varying from $1 to $1.80 per picul. In the Central District, the uncrushed and burnt bones are sold at the rate of 80 cents per picul for uncrushed bones and $1 per picul for burnt bones. In Malacca, the bones are classified by dealers into two groups i.e. large and small, the former commanding a somewhat higher price. Doubtless, bones from slaughter houses in other centres are similarly disposed of, and find ready purchasers.

The most consistent use of bones as a fertiliser in Malaya is found in Malacca, where it has long been the practice amongst Malays to employ this fertiliser, by a somewhat unusual method, in the cultivation of padi.

The Malays crush and burn the bones and then mix the ashes with water and soil. The padi seedlings, which are removed from the nursery when they are about 40 days, are steeped in this bone ash mixture for a day and night and are then transplanted.

Farmyard Manure.

The manure from the various dairies in the country, generally owned by Indians, is utilised in fruit growing and more generally in flower gardens. The supply is of little importance from an agricultural point of view.

It must not be forgotten that the Chinese market gardeners, scattered around the towns of any importance in Malaya are important local food providers. Their system of agriculture is intensive and the success of their enterprise therefore largely depends upon manuring. Many of them are pig breeders in addition and utilise the manure from the styes.

Conclusions.

From the foregoing account, it will be seen that, with the possible exception of Perlis guano, there are no large natural resources of fertilisers in Malaya.

Agriculture in Malaya has made use of the supply of natural fertilisers at hand, and it is evidence of the economic use of all fertilising material produced in the country.

OBSERVATIONS ON COCONUT CROPS.

BY

A. C. SMITH.

The primary object in analysing the yields from several adjacent blocks of mature coconuts was to determine if certain blocks of young palms were yielding returns commensurate with their age in comparison with the old heavy cropping areas at the same period after planting. Several interesting points were brought out which appeared worthy of record.

The soil in the main consists of well-drained sticky blue grey alluvial clay and is typical of most estates in the Lower Perak District. The palms throughout are planted 30 feet x 30 feet square (48 per acre) and water transport of the crop is the rule.

Accurate crop records from the various blocks have been maintained since first bearing, and as planting was commenced late in 1899 the period covered is 30 years which justifies one in forming fairly definite conclusions.

Cropping Capacities from Heavy Alluvial Soils.

In most countries where coconuts are grown on a large scale, the average soils are lighter in texture than those which support practically all the large commercial coconut areas in Malaya, whereas Sampson* is quite definite in his opinion that heavy soils are not generally suitable for the successful cultivation of the coconut. Nevertheless, our heavy alluvial soils, with good artificial drainage, have yielded very profitable crops, as will be observed from the diagram in which mean and annual yields are shown graphically for the several blocks. Blocks A to F, inclusive, totalling 1592 acres, produced in the eighth year an average of just over 1,200 nuts per acre or nearly 5 piculs of copra, which with normal prices should cover all expenditure. Block A of 103 acres, planted in 1900, has produced from its tenth year an average of 3,630 nuts per acre to date (twenty years). Similarly Block B, 294 acres, planted in 1901, has yielded annually from its tenth year 3,540 nuts per acre. Almost equally heavy crops have been harvested annually from the remaining blocks of which yields are portrayed in the diagram. Since 1913, the combined area (608 acres) of the three blocks A, B and C, has produced an average annual crop of 3,500 nuts per acre, equivalent to 14 piculs copra per acre (1 picul = 133⅓ lbs.), since 250 nuts may be taken as the average number required per picul. This is certainly a satisfactory achievement for any soil and compares very favourably with the best crop figures quoted by other countries. Yields have shown a definite tendency to decrease during the past four years. It may be that the soil is becoming exhausted and requires some form of stimulation, but crops are still extremely good and profitable. The diminution may also possibly be due only to the unusually

* Sampson, "The Coconut Palm". This conflict of Sampson's opinion and the experience in Malaya was pointed out by Belgrave in an article on "Coconuts on Heavy Soil", published in this Journal in June 1931. (Ed. M.A.J.).

prolonged dry seasons which have been experienced in this country during the past few years. Furthermore, the enormous crops of over 4,000 nuts per acre, which have been harvested in some years from the blocks portrayed, indicate that our heavy alluvial soils have wonderful productive powers when seasonal conditions are favourable.

How long our low-lying soils will be able to support these heavy crops is open to conjecture, but there are indications that where a high water-table is unavoidable it is highly probable that the profitable life of the palms will be restricted proportionately. The diagram shows that profitable crops have already been taken for twenty years from the older blocks, and though these areas may be past their prime, they certainly hold out prospects of remunerative crops for many years, (under normal price conditions) particularly if, as in other coconut producing countries, reasonable attention is paid to maintaining soil fertility.

The "Transitional" Stage in Production.

It has been shown by Jack* that on flat alluvial soils in this country, young palms of about 10 to 12 year old, after they have been yielding well for two or three years, experience a setback, or at least stagnate for a year or two before again producing good crops. Possibly this is an environmental effect resulting from a high water table, or possibly it marks the exhaustion of the nutriment in the top soil. The effect of the former might be that on the root system reaching water, natural development is temporarily arrested, causing a shock which retards growth until the palm has adjusted itself to the new conditions. The habit is not however, confined to low-lying areas, but has been observed in areas which maintain a deep water table—four feet or more—so that it is more probably a growth character marking the period between immaturity and full maturity. The diagram shows that this so called "transitional" period occurs approximately at the time when production is approaching its average, or in other words when palm yields have attained to within the limits of seasonal variation from the normal or mature yielding rate and are first affected by climatic factors.

Thus in Block A, planted 1900, this occurs in the eleventh year, when there was a definite setback, probably emphasised by climatic factors, as 1911 and the greater part of 1912 were dry years and mark a poor cropping period in all blocks, irrespective of age. Similarly in Block B, planted 1901, there is a setback in the tenth year, again probably emphasised and possibly hastened by the poor cropping period mentioned above. In Block C, planted 1902, the transitional stage has almost certainly been hastened by an unfavourable season and results in a drop in crop in the ninth year. Blocks D and E are affected by the presence of interplanted rubber but they also show a slowing down in the rate of crop increase in the ninth and eighth years respectively and a definite drop in production in the twelfth and tenth years respectively. Block F shows a slowing down in the ninth year and a definite setback in the eleventh year.

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*"Variation in Coconuts with particular reference to fruit production". *Malayan Agricultural Journal*, 1925. Vol. XIII. Page 33.

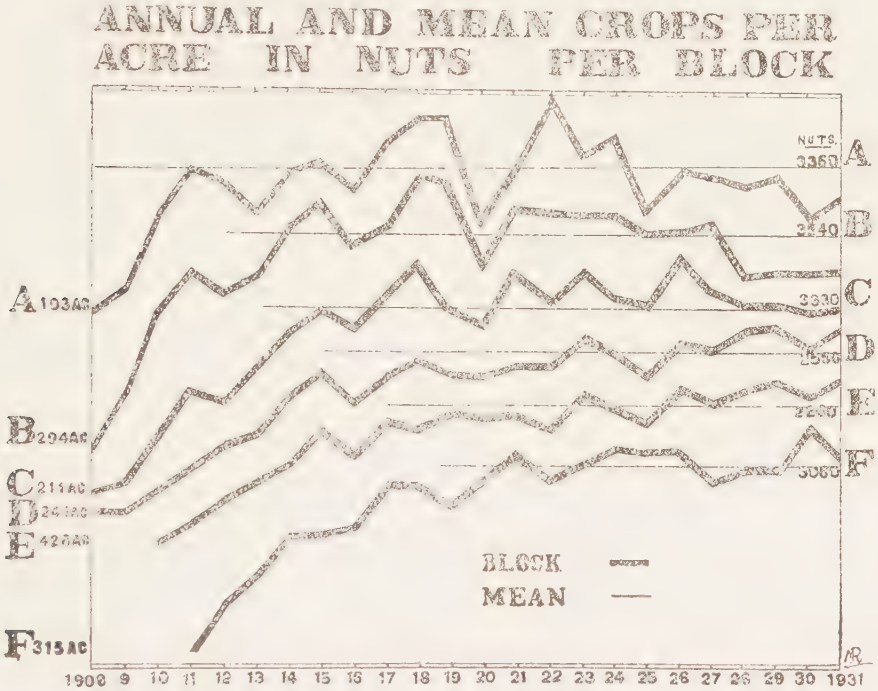
To bring out this point further, additional data were collected from two other estates in the locality, representing eleven blocks of mature palms totalling some 3,000 acres. These in every instance showed either a definite drop in crop or a decided slowing down in the rate of increased production between the eighth and twelfth years, in the majority of cases the period occurred in the tenth and eleventh years after planting.

The effects of this "transitional" or resting period therefore vary according to climatic conditions between a definite drop in crop, a more slowing down of the rate of increase of production, and a stagnant period of a year or two, and appears to be the more marked in soils in which palm growth and development are rapid.

Effects of Interplanted Rubber.

Blocks C, D, E and F were planted in 1902, 1903, 1905 and 1906 respectively and each block is well over 200 acres in area. Blocks D and E were interplanted with rubber in 1906. In 1922 the rubber was removed and in 1924 these blocks were given a fair application of artificial manures. The contrasting crops from each of these four blocks are shown graphically in the diagram which portrays the retarding effect of the rubber on the palms in Blocks D and E compared with those on adjacent blocks one year older and one year younger. The diagram also indicates the actual loss in crop due to the competition of the rubber, since the mean yields per block from the tenth year onwards are shown. Blocks C and F show normal rates of increase in crop from young palms under existing conditions until maturity is attained, and thereafter seasonal variations above and below the mean yields are indicated. Block C of 211 areas produced somewhat better crops than Block F of 315 acres, possibly because of slightly more favourable environmental conditions. Blocks D and E show similar rates of development but much slower than Blocks C and F. Thus Block F, planted one year later than Block E, exceeded it in crop returns almost from the beginning of it bearing period, and although Block D was planted three years before Block F, the latter in its third cropping year produced approximately the same crops and by its fifth cropping year had left Block D well behind. Block D (241 acres) is a better yielding block then Block E (428 acres) but the difference is undoubtedly due to soil conditions: Block E contains some pockets of stiff yellow clay. While the blocks are liable to vary slightly in their suitability for coconut cultivation, yet it is quite evident from the graphs that the interplanting of rubber in Block D and E had a definite retarding effect on the palms. When the rubber was removed in 1922 there was an immediate increase in yields, due partly to a favourable year, but also to the improved environment. Thereafter there was a definite upward trend in the crops, no doubt assisted by the application of artificials in 1924, although poor crops were garnered in 1925 which was a bad year climatically and the manures had not had time to take effect. The mean yields from Blocks D and E from their eleventh years onwards were 2,580 and 2,260 nuts per acre respectively, whereas the mean after the excision of the rubber increased to 2,850 and 2,460 respectively. The effect of the manures

may not appear to be very marked and is masked by a good cropping year in 1926, but there is no doubt that they have assisted in the maintenence of better average crops, as prior to its application the trend of yields was inclined to be downwards. The poorest yielding field of 77 acres in Block E was very thoroughly cultivated and manured. Returns were on the down grade, falling as low as 1,700 nuts per acre in 1924. The average yield for the four years 1923/1926 was 2,150 nuts per acre. For the four years 1927/1930 returns increased to an average of 2,900 nuts per acre from this field.



Conclusions.

(1). Coconuts planted in alluvial soil under normal European estate conditions should produce approximately five piculs of copra per acre in the eighth year—an amount which should cover all expenditure with normal commodity prices.

(2). Full mature yields should be obtained from the twelfth year after planting.

(3). Profitable yields should be maintained for at least 30 years.

(4). There is a definite "transitional" period in production about 10th—11th years.

(5). Interplanting with rubber definitely retards the rate of development of coconuts and seriously effects cropping.

(6). During the period of full productivity, wide variations in annual yields due to seasonal and climatic factors may be expected.

NOTES ON PADI STEM BORERS

BY

H. T. PAGDEN,

Assistant Entomologist.

Corrigenda to Bulletin No. 1, Scientific Series, June 1930.

1. The parasite recorded as *Trichogramma nanum* Zehnt. has been re-examined by Dr. Ferrière who states that it is definitely *T. minutum* Riley.

2. *Sitotroga cerealella* Ol., recorded as the laboratory host for *T. minutum*, was found on examination to be in a mixed colony with *Corcyra cephalonica* Staint., and *Ephestia cautella* Walk. The colony now consists mainly of *C. cephalonica*. The insects were determined by Mr. G. E. Bryant.

The following notes are a brief account of the work carried out on stem borers since the publication of Bulletin No. 1, Scientific Series and up to the end of 1930—31 padi season.

Alternate Host Plants.

During the fallow season following the 1929—30 padi season a search was made for alternate host plants of padi borers. This investigation covered the whole of the Krian District, parts of Larut and Matang and parts of Province Wellesley. Twelve new hosts of *Diatraea auricilia* Dudg., and four of *Sesamia inferens* Walk. were found. Three of these hosts were first recorded by Mr. F. R. Mason, Agricultural Field Officer, from the Sungei Acheh district of Province Wellesley and he demonstrated that padi stem borers are capable of living in quite small stemmed grasses.

The total number of plants now known to harbour one or more species of padi borer in Malaya is fourteen, excluding padi itself. These plants are shown in the following list together with two others which are doubtful hosts of *Diatraea*. The writer is indebted to Mr. W. N. Sands, Principal Agricultural Officer, Kedah, for identification of these plants.

In this list an asterisk or dagger indicates attack by *Diatraea* or *Sesamia* respectively. A circle indicates doubtful host of *Diatraea*. Numbers refer to the month in which the plant was first recorded as host. G. H. C. = first recorded by G. H. Corbett; F. R. M. = first recorded by F. R. Mason; H. T. P. = first recorded by the writer.

Alphabetical List of Host Plants.

Echinochloa colona Link.	† F.R.M.	5	(1930)	
Eleusine indica Gaertn.	† H.T.P.	7	(1930)	† Dept. Agric. (1929)
Eriochloa annulata Kunth.	† * F.R.M.	5	(1930)	
Hymenachne Myuros Beauv.	† H.T.P.	4	(1930)	
Ischaemum timorense Kunth.	° H.T.P.	6	(1930)	
Oryza latifolia Desv.	† * F.R.M.	5	(1930)	

Panicum auritum Presl.	° H.T.P.	6	(1930)	
Panicum repens L.	† H.T.P.	6	(1930)	
Paspalum orbiculare Forst.	† H.T.P.	6	(1930)	
Paspalum punctatum Burm.	† H.T.P.	3	(1931)	
Saccharum officinarum L.	† * H.T.P.	6	(1929)	
Sacciolepis myosuroides Ridley	† H.T.P.	4	(1930)	
Scirpus grossus L.	† * H.T.P.	6	(1929)	
Setaria rubiginosa Miq.	† * H.T.P.	6	(1930)	
Vetiveria odorata Virey	† H.T.P.	6	(1930)	
Zea Mays L.	† G.H.C.	11	(1923)	† H.T.P. 5 (1929)

Under laboratory conditions *Sesamia* can feed in *Hymenachne, Sacciolepis* and the grass *Coelorrachis glandulosa* Staph. besides its usual hosts. *Diatraea* will also eat *Coelorrachis.*

A Pyralid, determined by Mr H. M. Pendlebury of the Selangor Museum as *Nephopteryx* sp. *sensu lato,* was found to be a common borer in the stems of *Coelorrachis* and can feed in padi but it has not been found to attack it under natural conditions.

Many of the wild hosts recorded grow in places which do not receive the attention of the padi cultivator so that there is always a ready source of infection of the padi.

No alternate host of *Schoenobius incertellus* Walk. has been found, nor has the writer succeeded in finding aestivating larvae or pupae. The writer believes that Schoenobius maintains itself almost entirely in self-sown and re-grown padi. In the Philippines and Japan the larvae and pupae are stated to aestivate in stubble.

Light Trap Experiment.

This experiment was to serve two purposes.

(1) To ascertain whether light traps may be considered to be an effective control measure.

(2) To gain information concerning the fluctuations in the population of the imagines of stem borers.

These traps were set up slightly over a quarter of a mile from the road in the Government Padi Experiment Station at Titi Serong. They were spaced at 80 yards and each consisted of a hurricane lantern standing on a block of wood in a tray, 2 feet square by 3 inches deep, containing water with a film of kerosene on the surface. Each trap was protected from rain, which might overflow the trays and thus cause loss of specimens, by an attap shelter.

Some difficulty was at first experienced in separating worn examples of the males of *Schoenobius* and a species of *Chilo.* The latter insect, however, was never very numerous in the traps and as it has never been recorded as a padi pest in Malaya it was not included in the counts.

Two of the three traps were burned for a part of the night only while the third was kept alight all night. The hours were as follows.

No. 1	10.00 p.m. to 6 a.m.
No. 2	6.30 p.m. to 10 p.m.
No. 3	6.30 p.m. to 6 p.m.

The graphs figures 1 and 2 show the nightly catch, and the following brief account will serve to bring out the salient points and cover the period not shown on the graphs.

It will be seen that very few moths were obtained until January 1931, when *Schoenobius* became numerous between the 10th and 24th. *Diatraea* first became numerous in mid February. It will also be observed that both these insects exhibited marked periods of increase, *Schoenobius* in January, February, March and to a lesser extent April and *Diatraea* in February, March, April and May. In the case of *Diatraea* the greatest number of females was reached on the night May 5th to 6th with 321 individuals.

Those periods of increase were more or less defined between the last and first quarter of the moon, the only exception being the last period of *Diatraea* when the maximum was reached between the full moon and last quarter.

During these periods of increase there were large nightly fluctuations, most marked for *Diatraea* in March, and it was thought at first that these might be connected with the process of harvesting which was in full progress in the vicinity of the traps during that month. Subsequent comparison of the dates of harvesting the various plots did not show any connexion with the number of moths attracted to light and as similar fluctuations occurred subsequently it would appear that the mechanical disturbance and removal of cover does not influence the response of the insects. Furthermore, there does not appear to be any connexion between nightly rainfall and these fluctuations. The natives state that wind often causes a large number of moths to come to light in houses but it was not possible to investigate this statement.

It is particularly interesting to note the large number of *Diatraea* caught after harvest and indicating a flourishing population in the various grasses in the vicinity.

The writer's observations showed that more males than females of *Schoenobius* were captured, but that in the case of Diatraea females predominated.

With regard to the ratio of the sexes of *Schoenobius*, Shiroki, in Formosa, has shown that females are attracted to light in greater number than males except at the time of emergence of a generation when males predominated. His results are supported by five years observations. In India Ballard has found the same to be the case and he demonstrated that out of 13,640 females captured 35.5 per cent. had already deposited their ova.

That the results obtained in the particular district of Malaya where the present investigation is being carried out should differ from those of Shiroki and Ballard is difficult to explain. It may be connected with the fact that there are no marked seasons in Malaya and that *Schoenobius*, once established on the

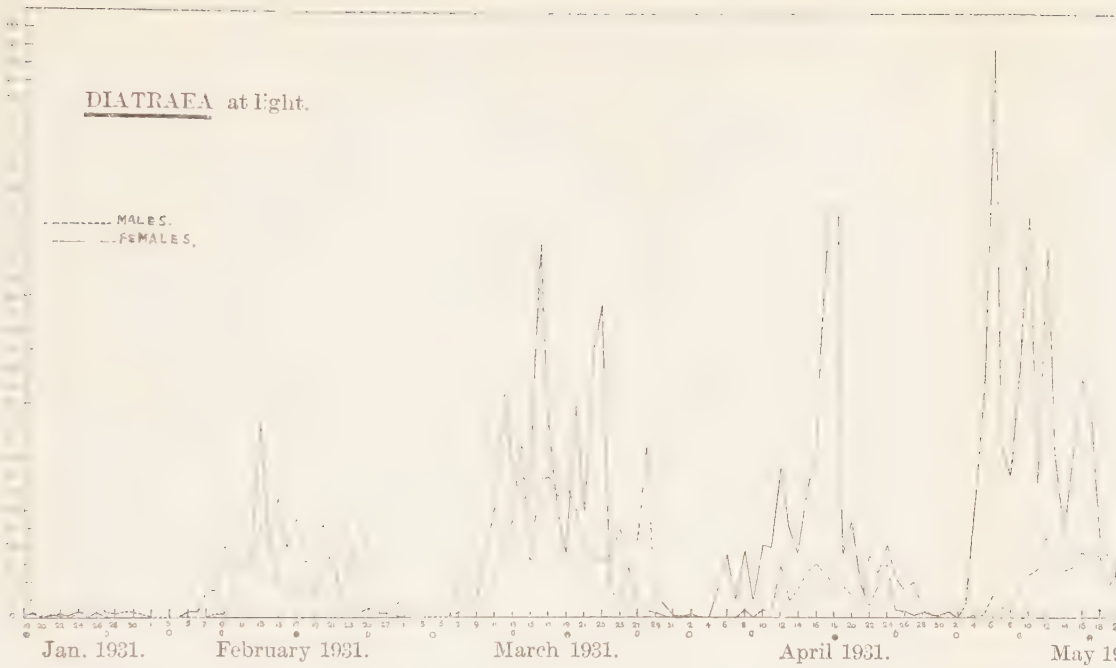

DIATRAEA at light.
MALES.
FEMALES.
Jan. 1931.
February 1931.
March 1931.
April 1931.

Fig. 1

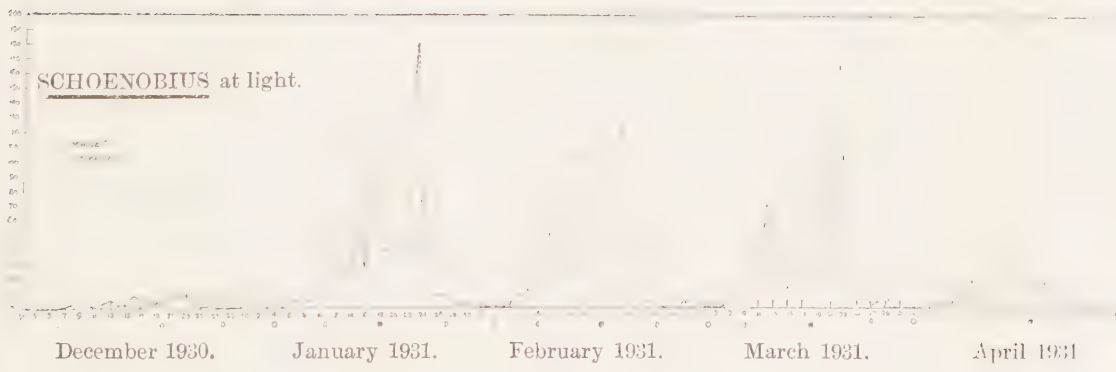

SCHOENOBIUS at light.
December 1930.
January 1931.
February 1931.
March 1931.
April 1931

Fig. 2

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increase, does not appear to exhibit clearly defined generations. Again in India there are well defined wet and dry seasons which are not so marked in Malaya and this may partly explain the difference in behaviour noted by Ballard and the present writer.

The response of *Sesamia* to light was found to be very weak and no graph is shown for this insect.

It was found that the males of all three insects are attracted throughout the night but that females came more readily during the early hours.

The total number of moths caught from September 1st, 1930 up to and including June 14th, 1931 was as follows.

		Males.	Females.
Diatraea	...	2,700	5,184
Schoenobius	...	4,277	2,191
Sesamia	...	461	60

Damage Caused by Borers.

The experiment was planned as follows. One acre was divided into tenths and five of these were examined daily for ova of *Diatraea* and *Schoenobius*. *Sesamia* could not be included as the position of its ova within the leaf sheath rendered collection impracticable. Five trained coolies were used for this work and were supervised continuously. They were instructed to cover the half acre in three days, or a day less than the minimum recorded incubation period. It was hoped that the removal of a large number of ova would sufficiently reduce the borer population in the treated half to give some indication of the damage caused by these insects.

The result was negative.

The ova collected were kept in the laboratory to ascertain the extent of natural parasitism and the figures obtained were used as a check on induced parasitism in another area.

The number of egg-masses collected were as follows:—

Diatraea ... 2,450 averaging 72.8 + 1.97 ova per mass *

Schoenobius ... 5,049 averaging 109.2 + 1.67 ova per mass *

A reduction of 10.4 per cent. in bored stems was recorded. The figures were as follows:—

Plot No.	1	2	3	4	5	6	7	8	9	10
Percentage bored stems	53	40	50	32.4	35.9	46.2	52.9	45.1	62.1	57.6

Plots 1 — 5 (treated) average	42.2 per cent.
Plots 6 — 10 (untreated) average	52.6 per cent.
Difference	10.4 per cent.

* The error is calculated on 377 and 976 actual counts for *Diatraea* and *Schoenobius* respectively.

The yields gave entirely contradictory results.

Plot No.	1	2	3	4	5	6	7	8	9	10
Yield	7.5	7.5	10.25	7.0	9.16	11.75	11.5	8.5	8.75	6.16

Average yield for plots 1 — 5	8.28 gallons
Average yield for plots 6 — 10	9.33 gallons
Difference	1.05 gallons.

The yields were taken from 1/40 acre in each plot and were recorded in gallons.

The following table shows the plots arranged in order of good yield, good tillering and severity of borer attack.

Yield	6	7	3	5	9	8	1 & 2	4	10
Tillering	2	5	1	4	3	6	10	7	9	8
Borer attack	4	5	2	8	6	3	7	1	10	9

It is apparent from this table that there was no connexion between yield, tillering and borer attack.

Experiment with *Trichogramma minutum* Riley.

This experiment was designed on similar lines to the foregoing in so far as arrangement of plots was concerned and was situated about three miles away so that no parasite spread could take place. Parasites were liberated over this plot and over the surrounding 30 odd acres. Daily liberations were made from the time of the first transplanting until flowering and the rate of liberation was about 1,300,000 per acre.

For the purpose of estimating parasitism a daily collection of egg-masses was made as in the previously described experiment, the number collected during the whole period being 5,129 *Diatraea* and 7,756 *Schoenobius*, the average number of ova in a mass being as recorded previously.

The number of egg-masses collected daily both in this Experiment and the control is shown in the graphs Figs. 3 and 4.

The results obtained against *Diatraea* were apparently promising, but it must be remembered that the number of parasites liberated was enormous and that unless equally good results can be obtained with about one hundredth of this number the parasite cannot be considered as an economic means of control.

The graph Fig. 5 shows the percentage of egg-masses of *Diatraea* in which the parasite occurred in the colonised area plotted against the natural occurrence in the control experiment. It should be stated that the percentage refers, not to individuals, but to egg-masses as a whole. It was not possible to count individual ova when the number of masses collected daily was large.

It was conclusively demonstrated that liberation of *T. minutum*, even in vast numbers, is inaffective as a control measure for *Schoenobius*, the parasite being unable to penetrate to the inner layer of ova. *Phanurus beneficiens* Zehnt.,

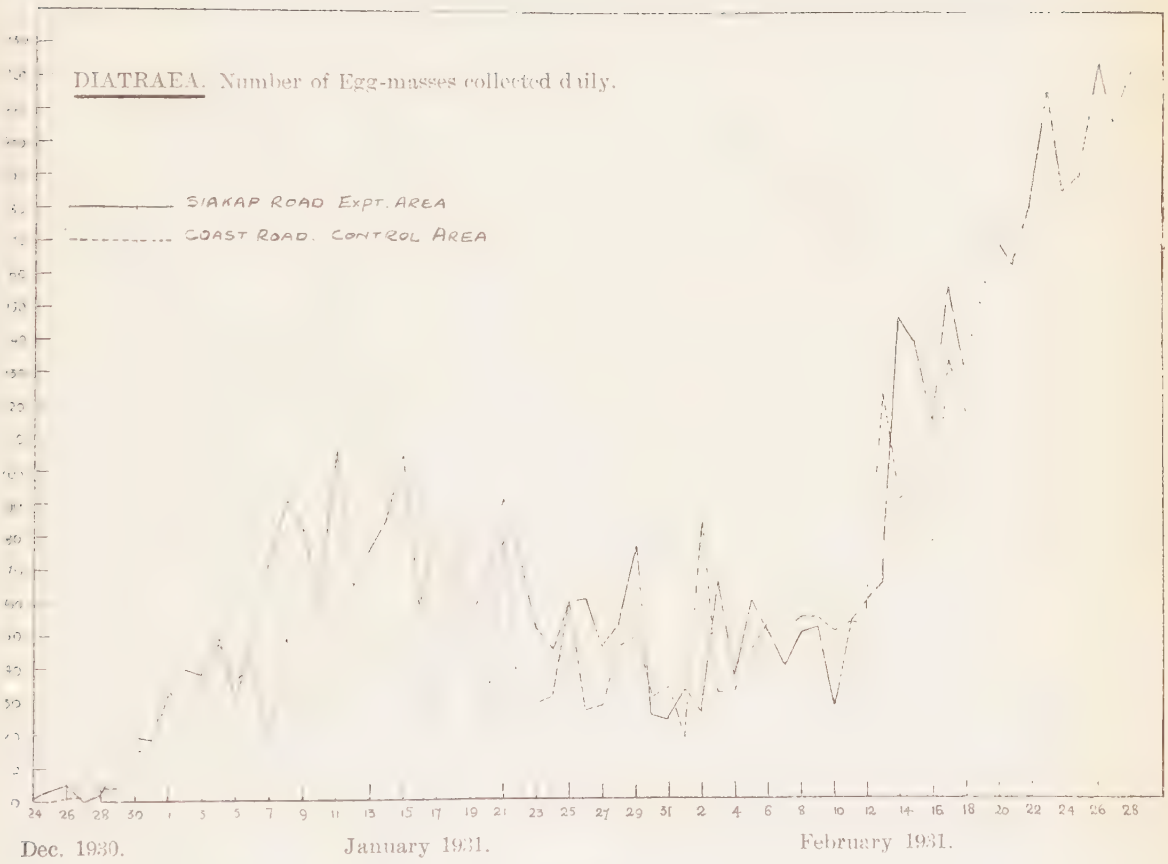
DIATRAEA. Number of Egg-masses collected daily.
SIAKAP ROAD Expt. AREA
COAST ROAD. CONTROL AREA
24 26 28 30 1 3 5 7 9 11 13 15 17 19 21 23 25 27 29 31 2 4 6 8 10 12 14 16 18 20 22 24 26 28
Dec. 1930.
January 1931.
February 1931.

Fig. 7

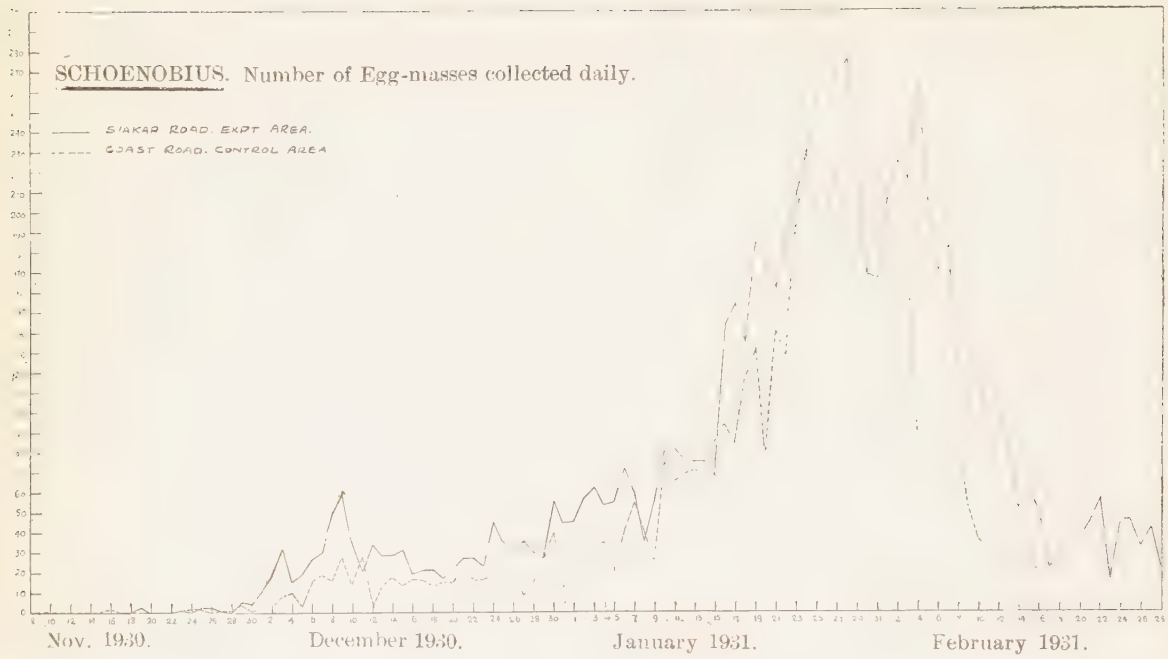
SCHOENOBIUS. Number of Egg-masses collected daily.
SIAKAR ROAD. EXPT AREA.
COAST ROAD. CONTROL AREA
Nov. 1930.
December 1930.
January 1931.
February 1931.

Fig. 4.

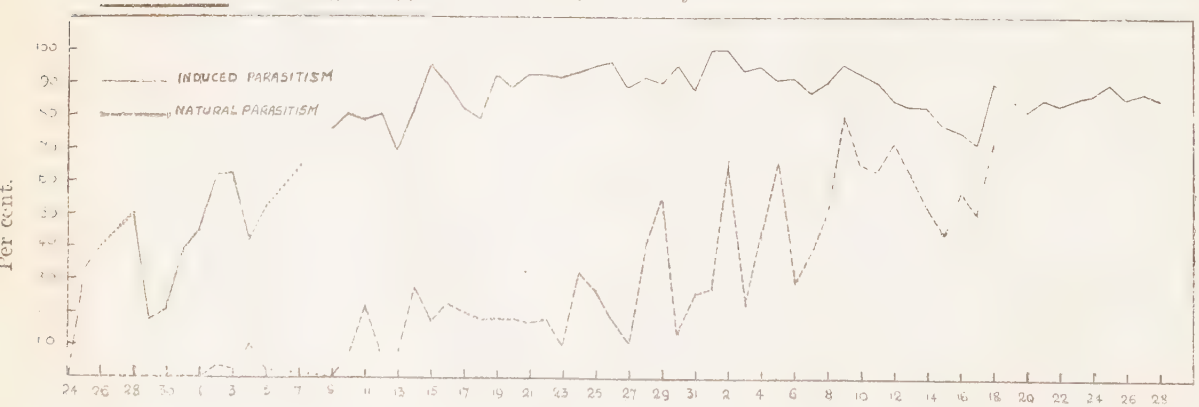
DIATRAEA. Percentage of egg-masses showing attack by T. MINUTUM.
INDUCED PARASITISM
NATURAL PARASITISM
Per cent.

Fig. 5.

on the other hand, is a highly efficient natural parasite of this insect, but it hardly ever attacks ova of *Diatraea* in the field.

Two other parasites found to attack ova of *Schoenobius* are *Tetrastichus schoenobii* Ferrière (1931) and *Eupteromalus* sp. The writer is not certain of the identity of the latter as the name alone has been received from the Imperial Institute of Entomology, *Tetrastichus*, however, appears to be very important late in the season as its larvae, in their later stages behave as predators and devour not only ova but larvae which have hatched and remained beneath the covering of the egg-mass.

Comparison of Borer Attack in Colonised and Uncolonised areas.

The following table shows the percentage of bored stems in the areas examined. It will be seen that there was a difference between the colonised and uncolonised areas of 13 and that other areas examined suggest that the parasites are greatly affected by the prevailing wind.

Percentage Borer Attack in Areas Examined.

Control Area plots 1 — 5	42.2 per cent.
Control Area plots 6 — 10	52.6 „ „
Control Area average	47.4 „ „
Parasitised Area plots 1 — 5	38.8 „ „
Parasitised Area plots 6 — 10	29.9 „ „
Parasitised Area average	34.3 „ „
Parasitised Area average over 33 acres	23.1 „ „
Area to leeward of Parasitised Area	27 „ „
Area to windward of Parasitised Area	42.7 „ „

Yields.

The yields from the special plots in the parasite colonised area gave no better information than did those in the control. The same strain of padi, Seraup kechil 36, was used in both places and the land was reputed to be similar as regards productivity. It is not considered necessary to give full figures in this note. The averages are given below recorded in gantangs or gallons.

Plots 1 — 5	5	8.28
Plots 6 — 10	8	9.33
Average for all plots	6.5	8.8

Summary.

It was found that *Diatraea* ova are a natural and attractive host of *T. minutum* but are only rarely attacked by *Ph. beneficiens*. The latter insect is, however, an important natural parasite of *Schoenobius* ova.

A third parasite, *Tetrastichus schoenobii*, may prove even more efficient against *Schoenobius* than is *Phanurus* as it almost invariably completely destroys those egg-masses in which it occurs, while *Phanurus* only does this in the case of small egg-masses.

During the course of the work an egg-parasite was bred from ova of *Sesamia inferens* Walk., found in the grasses *Oryza latifolia* and *Setaria rubiginosa* and is mentioned here as it is the first record of an egg-parasite of *Sesamia* in Malaya.

~~Sensational~~ Seasonal Variation in Borer Population.

The work has not been in progress sufficiently long to enable the writer to make any definite statement on this subject.

The evidence so far obtained suggests that there is a sequence of borers and that *Schoenobius* is the earliest to appear. In the season under discussion the ova of this insect first became numerous in late December, the imagines appearing in numbers at light in January. They almost disappeared in April.

Diatraea followed *Schoenobius* about a month later and ova were still on the increase at the end of February when egg-collection had to cease owing to flowering of the padi. The imagines first became numerous at light in February and continued until mid May.

Sesamia appears to follow *Diatraea* fairly closely but in a normally early season its occurrence would probably be too late to cause serious damage to the padi.

During the 1929—1930 padi season, which was an abnormally late one, larvae of *Diatraea* were abundant in padi until the end of May but *Schoenobius* larvae became scarce in late April and were almost absent in May although there was still plenty of food. This observation supports the view expressed above and the data at present available suggest that the date of appearance of padi borers is very little influenced by the stage of growth of the padi. If this supposition is subsequently found to be accurate it should be possible, given adequate irrigation and drainage, to advance the date of sowing sufficiently to reduce damage to a minimum.

Miscellaneous Observations.

Migration of *Schoenobius*.

During the course of field work it was found that the larvae of *Schoenobius* were capable of migration from one plant to another even with water on the fields.

The writer believes that he is correct in the statement that this fact has not been recorded previously and as the method of locomotion is peculiar a brief note may not be out of place.

The transfer is effected as follows. The larve emerges from the stem and cuts a portion of leaf somewhat longer than its own body. The leaf has a natural tendency to roll up on dessication and the larva presumably makes use of this property to obtain a tube the edges of which it weaves together with silk and finally closes one end with the same material. In this tube the larva can float on the surface of the water in a similar manner to larvae of *Nymphula*. When it encounters a stem of another plant it attaches its case at the open end by means

of a ring of silk and penetrates the stem leaving its case adhering to the exterior.

Only larvae which are nearly adult appear to indulge in this practice.

Identification of Attack.

In a previous paper (7) it was stated that borer attack is distinguishable from attack by *Leptocorisa,* or other insects, and birds attacking the ear, by the complete whitening of the panicle. This statement needs modification. The writer has frequently observed plants with a number of irregularly distributed white ears and flowers. These may be due to attack by Rhynchota, Orthoptera or even birds, but are also caused by borer larvae. Both *Diatraea* and *Schoenobius* are responsible but the latter is more frequent. The whitening is caused by very young larvae entering the flowers while they are still enclosed in the sheath, feeding in these and destroying the essential organs. Panicles exhibiting this form of attack are usually distinguished on close examination by small round holes in the glumes.

Unidentified Parasites of Borers.

Various unidentified parasites of borers have been encountered. Among these the most important would appear to be a Tachinid attacking larvae of *Diatraea* and *Sesamia.* This parasite appears to attack the young larva and to emerge from the adult larva or pupa. Second instar larvae collected in the field have produced the parasite when adult. Nothing is known of its ovipositing habit.

The insect is recorded under number 6965 in the Entomological collection of the Department of Agriculture.

A Proctotrupid, No. 6971, believed to be parasitic in the larvae of *Diatraea* was obtained from material in *Sacciolepis myosuroides.*

A Trichogrammid resembling *T. erosicornis* Wstw. was bred sparingly from ova of *D. auricilia* and is recorded under No. 6972, 25.6.30.

An Ichneumonoid parasite of *Schoenobius,* No. 7602 was obtained from pupae found when making stem counts. This is the first record of a pupal parasite of *Schoenobius* in Malaya.

Diptera Bred from Unopened Inflorescences.

Various Diptera have been bred from the unopened inflorescence of padi and the grasses *Oryza latifolia, Setaria rubiginosa, Erichloa annulata* and *Sacciolepis myosuroides.* Some or all of these may prove of importance in padi cultivation. Conspicuous among them is a bluish black Trypetid with densely mottled wings. The larva of this has been found in the stem of *S. myosuroides* just below the inflorescence and appears to be a facultative predator of *Diatraea* though the larva of the latter may have died from other causes. The normal habitat appears to be the upper part of the stem and the unburst flower spike of padi and other grasses. The imago is common in padi fields where it may be observed resting on the leaves.

Other Insects Observed.

Among the Coleoptera the curculionid, *Aorus ferrugineus* Boh., has been captured at light and its larva and pupa have been obtained from the rhizomes of the sedge, *Scirpus grossus*.

A Halticid, the larva of which frequents the grass *Setaria rubiginosa*, living beneath the leaf-sheath and in the unopened inflorescence, appears to attack other grasses though it has only been bred from the above mentioned species.

The Erotylid, *Anadastus* sp., No. 6964, is a common insect in the grass *Coelorrachis glandulosa* and can feed in padi under laboratory conditions.

The Coccinellid, *Alcsia discolor* F., and the Staphylinid, *Paederus fuscipes* Curt., are to a certain extent predators and have been observed devouring parasitised ova on egg-cards. The former, however, feeds in all stages on padi flowers and appears to prefer these.

Various Orthoptera, Tettigoniidae, are also a serious factor in the destruction of egg-cards and may completely destroy them before emergence of the parasite is complete.

Habit of *Schoenobius* Larvae.

It has been observed that young larvae of *Schoenobius* often remain within the egg-mass for a day or two after hatching and that at the time of leaving the egg-mass only a few exit holes are made, usually at the junction of the egg-mass with the leaf, the larvae following each other through these. This habit is undoubtedly favourable to the parasite *Tetrastichus schoenobii* whose larvae behave as partial predators.

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Abstracts.

VEGETATIVE PROPAGATION.*

A fresh plant may generally be raised by two methods; from seed, or from some fragment of a parent plant other than a seed, or, as in budded seedling stock, by a combination of both methods. Seed propagation involves a sexual act, and produces a definitely new individual which may or may not closely resemble the parent type. In most orchard crops, the offspring usually show considerable variation. Vegetative propagation is not a sexual process and does not produce a new type, it merely extends the original parent type.

Considerable advantage has been taken of vegetative propagation with temperate orchard crops, and there is every reason to anticipate that a wider application of such methods to tropical crops would prove of advantage. The realisation of this will depend primarily on the discovery of methods of vegetative propagation suitable to commercial application, and secondly, in the interest shown by planters in the use of vegetatively raised stock.

The practical classification of methods of vegetative propagation may be made into :—

(1) Rooting processes, and
(2) Grafting processes.

The first group of methods aims at the production of new roots and shoots upon plant parts such as stems, roots, or even leaves, the new root and shoot system being eventually established as a new plant. This group may be further subdivided according to whether the new roots are formed while the organ is still retained on the parent plant, or after it has been removed as a cutting.

Thus there are :—

(1) Layering, stooling and allied processes such as "bagging" or "marcotting".
(2) Cuttings, which may be either hardwood or softwood stem cuttings, root cuttings or leaf cuttings.

The second main group consists of the method of grafting, budding and approach grafting, sometimes collected under the general term "graftage". There are many modifications of practical methods, but the basic principle is always that of inducing the tissues of two separate plants to grow together, in order to form one composite plant. In grafting or budding, a part of one plant, either a small piece of stem or a piece of bark including a bud, is removed and placed in contact with the cambial tissue of the other plant so that the tissues grow together. In approach grafting, two plants are made to grow together while each is still on its own roots, by removing the bark from portions of the stems to expose the cambium and binding the two stems together with the bared surfaces in contact.

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*The following is the Summary of an article under this title (slightly extended by reference to the article), by E. E. Pyke, B.Sc., A.R.C.S. (London), published in *Tropical Agriculture* Vol. IX No. 1 January, 1932.

Advantages.

The advantages of vegetative propagation are as follows :—

(c) *Uniformity.* The extension of a type by vegetative propagation makes possible a degree of crop uniformity, both of yield and of quality, which is rarely attained in a seedling population. This uniformity is of great advantage both in the scientific and the commercial fields. In scientific work a high intrinsic variability in the experimental material obscures the variability caused by the experimental conditions; for the grower, the presence of low yielding types increases the overhead costs of the plantation.

The root stock upon which a variety is budded often has a marked influence upon the yielding capacity of the scion. If uniform yielding material is required, the variety must either be established on its own roots by root cuttings or stool shoots or else it must be budded on to a clonal root-stock. Only if the root system is clonal can a reasonable uniformity of yield be obtained.

(b). *Extension of Environmental Range of a Crop.* The isolation of individual plants, chosen for special qualities, such as cold or drought tolerance, and their subsequent vegetative propagation can increase the range of cultivation of a crop by bringing in districts which are unsuited to the average type. This is analogous to the breeding of hardy strains of wheat, when however, vegetative propagation is not necessary to fix a type, as pure genetic lines are readily raised.

(c). *Increase of Vigour of Weakly Types by working on to Suitable Clonal Root-Stocks.* In temperate horticulture it is a standard practice to work certain varieties on to vigorous stocks, thus improving either their vegetative growth or cropping capacity, or both. In tropical crops, modern breeding work will probably produce delicate varieties which require the assistance of hardy root-stock.

(d). *Propagation of Sterile Types.* Some desirable fruit varieties such as seedless oranges, grapefruit and sapodillas, are highly sterile and thus cannot be propagated by seed. In these fruits, vegetative propagation must be used to extend the variety.

(e). *Early Maturity.* A bud from a seedling may often be made to grow and bear fruit sooner than the original seedling, by working it on to a stock. This hastening of maturity would be of great value in speeding up genetic work on an orchard crop.

Disadvantages.

(a). *Initial Cost.* The first cost of a vegetatively raised nursery plant will usually be higher than that of a seedling planted at stake. However, the increased yield expected from such nursery plants should amply justify the initial increased expenditure.

(b). *The Root System.* A tap-root is by definition an organ peculiar to a seedling. However, exactly similar functioning roots can grow on vegetatively raised plants. It is highly probable that in most orchard crops, after a certain age, the root systems of trees which grew from seedling root-stocks and those

which grew from vegetative root-stocks will be found to be indistinguishable. Even in seedlings it it doubtful whether the primary tap-root is persistant in a mature tree.

(c). *Senescence and Degeneration.* Does continued vegetative propagation necessarily result in any lack of vigour, either vegetative or sexual, in the plant? The question of senescence always arises in connection with the vegetative extension of varieties. At the present day, the occurrence of true senescence in clones on continued vegetative propagation is neither proved or disproved. However, even if some senescence were proved to occur, it would not effect very much the policy of orchard crop growers, who normally would wish to plant new varieties from time to time rather than to replant with old varieties which would had begun to wane in popular favour.

There is, however, the problem of contamination of clonal varieties by rogue plants, either of seedling or clonal origin, or by diseased plants. This contamination may materially reduce the yield from a plantation and give the impression of senile change, or "running-out", in a variety. The solution must lie in the prevention of the propagation of rogue types by care in taking bud-wood or cuttings and by vigilence in the nursery.

(d). *Problems of Sterility within a Clone and between Clones.* Self-sterility occurs in many varieties of fruit crops. Even different varieties may not be sufficiently cross-fertile to ensure sufficient setting. Some edible fruits develop with a low percentage of ovules fertilised, and in these, high degrees of sterility occur without affecting yield. In a seed crop, however, a high percentage of ovules must be fertilised as seed is rarely produced without fertilisation. In such crops, therefore, precautions must be taken against sterility by planting mutually cross-fertile varieties together.

EXPORT OF LIQUID LATEX.

In view of the continued and extended export of liquid latex from Malaya the following abstract of an article on the International Trade in Liquid Latex published in The Rubber Age (U.S.A.) Vol. 30 No. 5 should be of interest.

Shipments of latex on an important scale commenced in 1922 and Malaya and Sumatra have been the chief sources of supply while the United States of America has been the chief consuming country. It is not possible to determine the exact extent of use in particular countries, since all importing countries do not give separate statistics of imports of rubber in the form of latex.

There is however, evidence of steady growth and imports into the United States of America which during 1930 and 1931 have established new high records.

The manufacture of concentrated latex also obscures the amount of trade since, unless the dry rubber content of the latex exported or imported is given or the latex is specificially described as concentrated, ordinary and concentrated latex are classified together.

Such figures are, however, available from Malaya as an exporting country and from America as an importing country.

Similar figures in respect of the Netherlands East Indies and Great Britain would be useful.

The following figures relating to annual exports since 1922 are of interest; those for 1922 are stated to be somewhat incomplete for Malaya and Ceylon. The figures are believed not to include concentrated latex.

It can be assumed that one gallon of latex represents 3½ lbs. of dry rubber, although the actual dry rubber content, especially during recent years is probably slightly higher.

During recent years the decline in the exports from Malaya is balanced by increased exports from Sumatra (or *vice versa*) due to the principle shipper operating in both countries.*

TABLE I.

Year.	Malaya gallons.	Ceylon gallons.	Sumatra gallons.	Total Reported gallons.
1922.	40,061	1,977	228,324	270,362
1923.	73,757	11,431	1,498,669	1,483,857
1924.	714,617	59,288	644,859	1,418,764
1925.	2,315,439	3,750	1,432,681	3,751,870
1926.	2,087,845	13,096	28,193	2,129,134
1927.	1,560,976	251	53,572	1,614,799
1928.	919,909	683	933,501	1,854,093
1929.	1,708,529	.....	833,153	2,541,672
1930.	815,186	.....	1,699,835	2,515,021

The United States imports of ordinary and concentrated latex are given in the following table.

TABLE II.

Year.	* Dry rubber Content. Pounds.	Value Dollars. (Gold).	Unit Value cts. per pound (Gold).
1924.	4,830,747	864,059	17.90
1925.	8,630,799	3,537,810	40.98
1926.	7,589,165	4,680,386	61.65
1927.	2,499,906	876,077	35.05
1928.	9,334,927	2,185,579	23.41
1929.	8,351,487	1,787,997	21.40
1930.	9,966,527	1,506,804	15.12
1931. (10 months).	9,190,362	801,935	8.73

The total dry rubber in pounds given in the table above for year previous to 1930 are therefore larger, since it may be taken for granted that a more correct figure for dry rubber content is 3½ lbs. instead of 3 lbs.

It will be observed that the unit value per pound of rubber is considerably higher than for raw rubber exported as such. This is due partly to the fact that latex at present commands a premium as a special product and partly because preserving, packing and freight charges are higher per unit of rubber content.

(It is of interest to note that an increasing number of estates in Malaya are now exporting preserved latex, although in the aggregate the exports have decreased since the United States Rubber Company Process Department has ceased the purchase and export of latex from Malaya and confined their attentions to exports from Sumatra. B. J. E.).

B. J. E.

* Prior to March, 1930, the dry rubber content of latex imported was estimated at three pounds per gallon. There is some reason for believing 3½ lbs. a better estimate. Since March, 1930, importers have been required to report the dry rubber content on declarations of imports of latex and latex concentrates at time of entry.

Departmental.

FROM THE DISTRICTS.

The Weather.

In the State of Kedah, in Malacca Territory and in Singapore Island the weather throughout February was hot and dry with strong North Easterly winds in Kedah, where conditions were ideal for the padi harvest. In Krian and the north of Perak, however, the weather was wet. Elsewhere in the Peninsula the first half of the month was hot and dry often with strong breezes and cool nights, while showers or thunderstorms of varying frequency and intensity were experienced in the latter portion of the month. On the East coast, where strong winds prevailed, rain storms gave a heavy precipitation in a few days.

Remarks on Crops.

Rubber :—There was a further decrease in the prices of small-holders' rubber which ranged in dollars per picul from 7—12.50 for smoked sheet, 5—10.50 for unsmoked sheet, 2—6.50 for lump and slab and 1.50—6 for scrap.

Wintering continued throughout the month, leaf fall on the whole being definite and complete, while in some areas the new leaf had begun to develop at the end of the month.

As a result of the decreased yields usual at this season, certain estates were rested and tapping was also discontinued on a number of the properties of intermediate size owned by Chinese and Chettiars. Moreover, the number of small holdings in tapping was further reduced by the incidence of the padi harvest, since many owners and even hired tappers, still employed on the share system, were either engaged in reaping their own crops or were working for wages in the padi fields.

Dry weather and in places cessation of tapping have caused a further reduction in the prevalence of Mouldy Rot Disease in most infected areas. No cases of Oidium Leaf Mildew were reported.

Padi :—In all the more important rice areas the harvest was in full progress during the month. It was completed in some Districts of Negri Sembilan and was nearing completion in Malacca and Pahang West. Weather conditions were favourable everywhere, except in Krian which experienced the difficulties due to a wet harvest. Both in Kedah and Krian the temporary shortage of labour continued. Yields so far obtained confirm the anticipation of a good crop in Kedah, Province Wellesley North and Malacca with satisfactory returns in most other parts of the country not affected by the December floods. In Malacca one of the selected strains, Siam 29, has given yields considerably in excess of the local unselected Siam variety and can now be recommended for wider distribution. The price of padi at the Government mill at Bagan Serai was 7.5 cents a gantang, while elsewhere in the north the range was from 5.5—7 cents. In other parts of the country prices varied from 6 to as much as 16 cents a gantang.

export during the present season from the Seven Inner Circles at approximately 1,314,000 tons of padi, or about 1,000,000 tons of rice.

Netherlands Indies.—Java and Madura. It is stated that the area harvested for the season 1931—32 amounted to 8,657,250 acres, a decrease of 1.6 per cent. as compared with 1930; the area damaged 446,030 acres, an increase of 90 per cent. over 1930, and additional plantings awaiting harvest to 2,975,250 acres, an increase of 0.5 per cent. as compared with the previous year.

The production is estimated at 6,117,421 tons of padi, a decrease of 7.6 per cent. over the previous year.

The production of dry padi is estimated at 535,714 tons of padi, being the same as in 1930.

French Indo-China.—Entries of padi at the port of Cholon for January 1932 were 81,096 metric tons, an increase of 65.2 per cent. as compared with January 1931.

Exports of rice from Saigon for January 1932 were 77,508 metric tons, an increase of 52.9 per cent. over those of January 1931. Both the padi and rice markets are stated to be quiet.

Ceylon.—Imports for the year 1931 were 436,667 tons, a decrease of 26,366 tons (5.7 per cent.) as compared with 1930. Of these imports, 16.3 per cent. were from British India, 75 per cent. from Burma and 8.7 per cent. from other countries.

Europe.—The quantities of rice shipped from the East were :—

(a) To Europe, period 1—21 January 1932, 35,255 tons, an increase of 83.6 per cent. Of this total 91.1 per cent. was from Burma.

(b) To the Levant, period January 1st to December 4th, 1931, 67,120 tons, an increase of 218.2 per cent. as compared with 1930.

(c) To the West Indies and America, period January 1st to December 3rd, 1931, 152,997 tons, a decrease of 23.7 per cent, as compared with 1930.

General.

The following is a summary of the principal facts which according to the International Institute of Agriculture monthly Crop Report for December 1931 have become available in the 1931—32 rice crop.

Exporting Countries :—

(a) Burma, a decrease of 2.2 per cent. in the planted area.

(b) Indo-China. A decrease in area planted of 10 per cent. in Cochin-China and 23 per cent. in Annam. There is no information regarding Cambodia.

(c) Among the minor exporting countries, Italy has had a yield below normal, Spain a small production, and the United States an increase of 5 per cent. above the average.

Importing Countries :—

(a) In India an increase in the area planted.

(b) In China the prospects are doubtful; the unprecedented floods of last summer destroyed a large proportion of the young rice of at least half the rice crop of China at a time when it was too late to replant, and is bound to affect the supply situation.

(c) In Japan proper the crop is estimated to be the lowest in recent years and 18 per cent. below that of 1930—31; in Formosa, the first crop, which is that exported to Japan, exceeded the record of 1930—31; in Korea, a decrease of 17 per cent. from the large production of the previous season and 7 per cent. above the average of the five years ending 1929—30.

(d) In Java, the production of wet rice is 4 per cent. below that of last year and 1 per cent. below the average, and for dry rice is 10 per cent. below last year and 1 per cent. above the average.

" Taking the situation as a whole, it appears that while, excluding Siam, for which estimates are not yet available but in which a considerable diminution in production is probable, the serious crisis in the great rice-exporting lands is reflected in a decline in area sown this year, the position in the principal rice-consuming countries in the immediate future appears unfavourable. Taking into account also the stocks still existing in the exporting and importing countries, the prospects of all the available supplies being absorbed remains, despite the smaller crop of 1931—32, doubtful. Prices remain at the low level registered in the earlier months of 1931, having recovered from the further drop that reached its lowest point in June. Amongst the great exporting countries, Indo-China seems, owing to the fall in sterling, likely to suffer still more severely from the competition of Burma. While, however, there are many doubtful factors in the present situation, further reductions in area in the coming season and an improvement in the purchasing power of the great consuming regions, especially of China, would bring distinct improvement in the market."

MALAYAN AGRICULTURAL EXPORTS, DECEMBER, 1931.

Product	Net Exports in Tons			
	Decr. 1930	Decr. 1931	Year. 1930	Year. 1931
Coconuts, fresh ...	665	1,900	10,475	10,468
Copra ...	7,344	9,810	102,014	100,809
Coconut Oil ...	735	874	9,475	9,909
Palm Oil ...	290	649	3,211	4,574
Palm kernels ...	54	82	485	726
Pineapples, canned	5,353	7,170	57,689	59,457
Tapioca ...	2,288	2,570	31,195	28,257
Arecanuts ...	1,924	1,740	23,254	19,266
Tuba root ...	3½	6	55½	74

ACREAGES "OUT OF TAPPING" FOR THE MONTH OF JANUARY, 1932.

(Estates of 100 Acres and over in F.M.S. and S.S.)

Territory	Tappable Area out of Tapping		Total area Untapped*
	Estates which have entirely ceased tapping	Estates which have partly ceased tapping	
Perak ...	7,799	26,839	34,638
Selangor ...	11,876	37,030	48,906
Negri Sembilan ...	13,262	22,174	35,436
Pahang ...	2,607	4,660	7,267
Total F.M.S. ...	35,544	90,703	126,247
Province Wellesley ...	2,882	8,465	11,347
Dindings ...	194	1,140	1,334
Malacca ...	4,120	16,837	20,957
Penang ...	797	49	846
Singapore ...	10,239	5,796	16,035
Total S.S. ...	18,232	32,287	50,519
Grand Total ...	53,776	122,990	176,766

* Areas rested due to the adoption of A.B.C. and similar systems of tapping in F.M.S. and S.S. during January (not included in the above figures) were :—F.M.S. 44,097 acres, S.S. 15,171 acres, Total 59,268 acres.

MALAYA RUBBER STATISTICS — TABLE I

STOCKS, PRODUCTION, IMPORTS AND EXPORTS OF RUBBER, INCLUDING LATEX, CONCENTRATED LATEX AND REVERTEX, FOR THE MONTH OF JANUARY, 1932 IN DRY TONS.

Territory	Stocks at beginning of month 1			Production by Estates of 100 acres and over		Production by Estates of less than 100 acres estimated 2		Imports				Exports including re-exports				Stocks at end of month		
								during the month		during the year 1931		during the month		during the year 1931				
	Ports	Dealers	Estates of 100 acres and over	during the month	during the year 1931	during the month	during the year 1931	Foreign	From Malay States	Foreign	From Malay States	Foreign	Local	Foreign	Local	Ports	Dealers	Estates of 100 acres and over
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
MALAY STATES :—																		
Federated Malay States	...	18,000	12,226	13,938	13,938	9,455	9,455	Nil	Nil	Nil	Nil	13,029	8,614	13,029	8,614	...	18,352	13,597
Johore	...	2,446	3,412	4,108	4,108	4,623	4,623	Nil	9	Nil	9	914	7,488	914	7,488	...	2,619	3,578
Kedah	...	448	2,156	2,528	2,528	1,343	1,343	Nil	Nil	Nil	Nil	630	3,004	630	3,004	...	565	2,539
Perlis	...	27	7	7	7	20	20	Nil	Nil	Nil	Nil	Nil	33	Nil	33	...	20	8
Kelantan ...	...	160	42	83	83	583	583	Nil	Nil	Nil	Nil	34	545	34	545	...	226	63
Trengganu ...	...	55	50	117	117	58	58	Nil	Nil	Nil	Nil	Nil	175	Nil	175	...	55	50
Total Malay States	..	21,136	17,893	20,781	20,781	16,082	16,082	Nil	9	Nil	9	14,607	19,859	14,607	19,859	...	21,777	19,835
STRAITS SETTLEMENTS																		
Malacca ...	...	5,658	1,264	1,628	1,628			Nil		Nil		5,027		5,027		...	4,470	1,349
Province Wellesley	...	102	535	571	571	(2	(2	Nil		Nil						...	95	636
Dindings ...	...	128	91	110	110	2,362	2,362	Nil	10,912	Nil	19,912	6,166	Nil	6,166	Nil	...	196	98
Penang	1,638	6,230	9	9	9			944		944						2,958	7,014	13
Singapore ...	2,099	38,607	287	173	173			7,083		7,083		16,828		16,838		4,155	41,018	236
Total Straits Settlements	4,737	50,721	2,186	2,491	2,491	2,362	2,362	8,027	10,912	8,027	19,912	28,031	Nil	28,031	Nil	7,113	52,723	2,326
TOTAL MALAYA	4,737	71,857	20,079	23,272	23,272	18,474	18,474	8,027	10,921	8,027	19,921	42,638	19,859	42,638	19,859	7,113	74,500	22,161

TABLE II
DEALERS' STOCKS, IN DRY TONS 3

Class of Rubber	Federated Malay States	S'pore	Penang	Province We'sly D'dings. M'cca.	Johore	Total
20	21	22	23	24	25	26
DRY RUBBER	15,265	37,184	6,676	4,446	1,154	64,725
WET RUBBER	3,087	3,834	338	245	1,465	8,969
TOTAL ..	18,352	41,018	7,014	4,691	2,619	73,694

TABLE III
FOREIGN EXPORTS

PORTS	For month	during the year 1932
Singapore ...	23,990	23,990
Penang ...	9,309	9,309
Port Swettenham.	6,590	6,590
Malacca ...	2,749	2,749
MALAYA ...	42,638	42,638

TABLE IV
THE PROPORTION OF FOREIGN EXPORTS REPRESENTING DOMESTIC PRODUCTION 4

AREA	For month	during the year 1932
Malay States ...	34,106	34,106
Straits Settlements		
MALAYA ...	34,106	34,106

Notes :—1. Stocks on estates of less than 100 acres and stocks in transit on rail, road or local steamer are not ascertained

2. The production of estates of less than 100 acres is estimated from the formula : Production + Imports + Stocks at beginning of month = Exports + Stocks at end of month, + Consumption, *i.e.*, Column [7] = Columns [13] + [14] + [17] + [18] + [19] + [19A] − [2] − [3] − [4] − [5] − [9] − [10]. For the Straits Settlements, Columns [7] and [8] represent purchases by dealers from local estates of less than 100 acres, reduced by 15% to terms of dry rubber.

3. Dealers' stocks in the Federated Malay States are reduced to dry weights by the following fixed ratios: unsmoked sheet, 15%; wet sheet, 25%; scrap, lump, etc., 40%; stocks elsewhere are in dry weights as reported by the dealers themselves.

4. The proportion of foreign exports representing Malayan domestic production is estimated by deducting the average monthly dry weight of foreign imports over a period of 2 months from the gross foreign exports of the later month, the foreign exports of the Malay States being domestic production.

5. The above, with certain omissions, is the Report published by J. I. Miller, M. C. S., Acting Registrar-General of Statistics, S.S. and F.M.S., at Singapore on 23th February, 1932.

In some parts of Selangor preparations are being made to plant a five months' inter-season crop and so to obtain two crops during the next twelve months.

Some 6,000 gantangs of seed have been sent from Malacca to the east coast of Pahang for early planting in the fields where the crop was destroyed by the floods.

Coconuts :—Heavy mortality has been noted in the coconut palm area between Batu Pahat and Benut on the west coast of Johore. The reason assigned for this is repeated flooding of some parts of the area during periodic high tides. Much of this area cannot be effectively drained, with the result that stagnation of the soil water and inundation by salt water appear to be the factors mainly responsible for the debility and subsequent death of the palms.

Tobacco :—Interest in this crop is on the whole well maintained, though prices are becoming stabilised at figures below those first obtained in districts where the crop is no longer new. The usual range of prices has been between $15/- and $40/- per picul, but in Selangor 5 piculs of cured leaf were sold locally at $70/- per picul, while in Pahang West 3 piculs of cured leaf sold for $40—$45 per picul and 2 piculs of prepared tobacco at about $1/- per kati.

Pineapples :—It is now being realised that during the next two or three years considerable areas of pineapples will be removed as the rubber with which they are interplanted becomes mature. This fact compared with the improved prices paid for fruit by the factories during the last few months, has revived interest in pineapple cultivation and led to consideration of the possibility of using this plant as a main crop rather than as a catch crop with rubber. Interested growers are endeavouring to obtain extensive tracts of land for planting. There is still much land in Johore eminently suitable for this crop, except that it is situated at a considerable distance from existing factories, so that questions of transport require careful consideration.

Rat Control in Padi Fields :—In Krian since control measures in the padi field are no longer required, attention was directed towards known breeding grounds, dwellings and their surroundings providing harbours for rats. The only breeding season observed since July 1931 commenced during the month. The breeding season also appeared to have commenced in Malacca where 47,940 rat tails were collected, many being obtained by digging open holes in the bunds of the padi fields.

Agricultural Stations and Padi Test Plots.

KEDAH. *Telok Chengai Rice Station and Padi Test Plots.*—Harvesting of certain of the more important experimental fields, including the manurial experiments and ear to row lines of selected local varieties, was completed at the Rice Station under favourable weather conditions. Yields and other data were recorded. Harvesting at the Jitra and Langgar Test Plots was also completed but at the Sala Kanan and Rantau Panjang plots the padi was not fully ripe.

PROVINCE WELLESLEY. *Glugor Padi Test Station.*—Harvesting of two varieties, Sm 29 and R 4, commenced towards the end of the month; the former proved a shorter season padi in Penang than elsewhere, having ripened consider-

ably before the other six-months varieties. Nurseries were prepared and seed sown in the middle of the month for the trial inter-season crop.

Bukit Merah Padi Test Station.—Harvesting was commenced and under ideal conditions except for one variety F 756. Some of the varieties have given exceptionally good yields, though the final figures are not yet available. A demonstration was given to 35 local headmen and prominent cultivators at this station before harvesting commenced. Much interest was aroused, especially in the irrigation system.

PERAK. (*a*) *Agricultural Stations. Selama.*—Rainfall during the month was adequate and it was hoped that this would give the necessary impetus to such recently planted material as survived the harmful effect of the drought in January.

Kuala Kangsar.—Part of the Station received an application of pen manure. Four varieties of sweet potato and a beds of Ubi Kling and brinjals were planted. A limited number of rambutan marcots and a bed of seedling avocado pear trees were ready for sale. The preparation of the beds for the sireh garden was completed. Chickens obtained by crossing a pure-bred Rhode Island Red Cock with local hens have proved considerably hardier than the pure bred Rhode Island chickens.

(*b*) *Padi Stations and Test Plots. Talang.*—Harvesting commenced in the first week of the month and had not been completed at its close.

Lenggong.—The crop on this plot was harvested during the month and the work of cleaning the padi in preparation for weighing was commenced.

Bruas.—Reaping was slow owing to uneven ripening while some of the heavy Seraup strains which had lodged proved troublesome to cut. The crop was likely to prove better than was at first anticipated.

Bukit Gantang.—Harvesting commenced on February 22nd. The plot was visited by the headmen of the District on February 18th and keen interest was evinced.

Kamunting Slimed Area.—Birds continued to ravage the crop throughout the month, so that it will only be possible to obtain fairly representative yields in two blocks. This is unfortunate as the crop, contrary to expectations, gave evidence towards maturity of being capable of yielding a satisfactory return.

Selinsing Manurial Trials.—Harvesting was commenced and completed during the month. Calculations were not completed, but rough computations show that yields varying between 251 and 344 gantangs per acre were obtained.

SELANGOR. *Cheras Agricultural Station.*—The work of planting up this Station continued; three varieties of tobacco were transplanted into the field and six varieties of betel nuts were sown in the nursery beds.

Kajang Test Plot.—Nursery beds of padi were sown at the adjoining Cheras Station in preparation for planting an inter-season crop.

Kuang Padi Station.—Clearing was commenced in preparation for the short inter-season crop and nurseries of N27 were sown.

NEGRI SEMBILAN. *Rembau Agricultural Station.*—Crops planted were marcots of chicku and rambutan, greater yam, suckers of two varieties of bananas

and a bed of Salisbury White Maize. Cover crops were dug in or used as a mulch and vacant spaces were sown with *Crotolaria usaramvensis* as a green manure.

Rembau Padi Test Plot.—Plots of F756 and F11 were harvested.

Pahang. *Kuala Lipis Agricultural Station.*—Grape-fruit marcots were taken for the Temerloh Station and others were prepared. The banana plot was supplied and plots of Soya bean and Virgina tobacco were sown.

Pekan Agricultural Station.—Several potatoes and vegetables were planted. The dry padi plot was harvested and the crop cleaned.

Padi Test Station, Dong.—Harvest was completed. The special sub-plots for experimental error trials were harvested, weighed and recorded.

Padi Test Station, Temerloh.—The nursery was prepared and sown with Radin 4, Radin 7 and Seri Ager strains.

Malacca. *Sungei Udang Agricultural Station.*—The clean-clearing and stumping of the padi area was completed and preliminary work for the irrigation of this area was carried out. The preparation of the root crop area was completed. Terracing of the coffee area was in progress. Five varieties of tobacco were sown in the nurseries.

Pulau Gadong Padi Station.—Harvesting was completed and the work of cleaning and weighing the crops from the various plots was continued throughout the month.

Singapore. *Pineapple Experiment Station.*—All plots of the Green Dressing Experiments with pineapples have been prepared for replanting, a dressing of artificial fertiliser will be applied before planting to assist the growth of the green manure plants on the somewhat exhausted soil.

A number of seeds of rambutan, pulasan, mangoesteen, jack fruit and chiku have been planted. Certain small plots and nursery beds have been planted with four kinds of tobacco to provide seed. A total of 61 plots each 1/40 acre, have been laid out for manurial experiments with the Hickory Prior variety of Virginian tobacco. The planting up of these plots was commenced towards the end of the month.

School Gardens.

The great majority of these gardens were closed for the year and padi planting holiday. Where as in Penang Island, the Dindings, parts of Perak and Selangor, work was recommenced during the month, it was confined to the cultivation and preparation of the beds for planting.

A commencement was made to establish school gardens in Johore State. Four selected sites were visited and approved as suitable.

In Singapore Island instructions were given for fertilising the beds and in some cases for extending the gardens.

DEPARTMENTAL NOTES.

Mycological Work.

In addition to the research work in progress, the Mycological Division of the Department deals with a large number of enquiries from all parts of the country. In one month recently, twenty-two specimens of plants attacked by fungus were submitted for examination and report. These specimens came from various parts of Malaya and included tea, coconuts, tobacco, oil palm, sireh, coffee, crotolaria, bracken and chengai, besides rubber latex and paint.

Retirement of Mr. F. G. Spring.

Mr F. G. Spring, N.D.A., U.D.A., F.L.S., Agriculturist (Rubber) retired from the service on 5th February, 1932.

Mr. Spring joined the Department of Agriculture, S.S. and F.M.S. as Superintendent of Government Plantations on 23rd September 1910. Two years later he was promoted to the post of Agriculturist and served in this office until the end of 1924, when he was appointed Agriculturist (Rubber).

In 1927 Mr. Spring was seconded to the Co-operative Societies Department where he served for over four years. During his period of service with that Department Mr. Spring carried out a survey of the conditions with regard to native manufacture of rubber which resulted in an important report on recommendations for Co-operative Societies among small-holders for the preparation and marketing of their rubber. He later supervised the work of commencing the first co-operative rubber factory amongst Malays in this country.

During his long service in the Department of Agriculture, Mr. Spring published in its official organs a number of valuable articles dealing with the results of research work carried out on the Government Plantations chiefly in connection with rubber, but dealing also with a number of other crops. In his official capacity he was responsible for the successful introduction of a number of economic and ornamental plants.

His colleagues in the Department of Agriculture extend to Mr. Spring their best wishes on his retirement from the service

Agricultural Office, Singapore.

The office of the Agricultural Field Officer, Singapore, has now been moved to the 5th Floor, Fullerton Buildings, Singapore.

Pigs for Sale.

Attention is directed to the offer of sale of over 30 pigs from the Government Stock Farm, Serdang, particulars of which will be found in the advertisement pages of this issue.

The pigs include Black, and crosses between Chinese sows and Black, and Chinese sows and Middle White, which have been bred on the Stock Farm.

Applications should be addressed to the Senior Assistant Agriculturist, Serdang, Selangor.

Vernacular Publications.

The last issue of the Malay quarterly journal of the Department (*Warta Perusaha'an Tanah*) is an extra large number, consisting of a free translation of Special Bulletin General Series No. 1 "The Culture of Vegetables in Malaya" by B. Bunting and J. N. Milsum, but omitting reference to crops only suitable for cultivation in the Highlands. In view of the anticipated increased demand for this number owing to its general utility, especially in connection with school gardening, 10,000 copies have been printed. This illustrated publication is available for free distribution to small-holders in the Federated Malay States and Straits Settlements. Outside this area, the price is 15 cents per copy.

Statistical Work.

The agricultural statistics for the Federated Malay States and Straits Settlements for the year 1931 are being compiled. In relation to rubber, the annual statements include area planted in 1931, area of tappable and immature rubber at end of 1931, area budgrafted in 1931, all in relation to estates of 100 acres or over.

Statistics are also being compiled of the planted area of oil palms and crops of palm oil and kernel for 1931.

It is possible that newly planted estates exist which have not been reported to this Department. Owners or managers of rubber or oil palm estates who have not yet rendered these returns for 1931 are requested to notify the Department, when the requisite forms will be sent for completion and return.

Leave.

Mr. F. de la Mare Norris, Principal Agricultural Officer, Johore has been granted 9 months and 18 days leave on full pay with effect from 5th February, 1932.

Mr. R. B. Jagoe, Assistant Botanist, returned from leave of absence on 5th February, 1932.

Statistical.

MARKET PRICES

February, 1932.

The Chinese New Year and the "Hari Raya Puasa" holidays, both falling at the beginning of the month, curtailed business on a listless market, resulting in a small volume of business with little alteration in prices. Later, however, an improvement was noticed, the Tariff proposals at Home possibly exercising some influence.

Rubber.—The average spot price of rubber smoked sheet equal to London Standard was 8.18 cents per lb. in Singapore, as compared with 9.92 cents for January. The London average price was 2.71d. and New York 3.95 gold cents per lb. as compared with 3.05d. and 4.49 gold cents respectively in January.

Palm Oil.—Cabled quotations C.I.F. Liverpool on a basis of 18 per cent. F.F.A. during February were as follows:—February 3rd, 10th. and 17th. £21 per ton, February 24th. £21.10. The market has been steady.

Copra.—The market for this product experienced a sharp rise from $6 per picul for Sundried at the beginning of the month to $7.05 on 22nd, followed by a rapid fall to $6.45. The rise was in sympathy with the demand from Europe and America. A contributory cause to this advance is probably the uncertainty in regard to the Soya bean crop as a result of hostilities between China and Japan. The subsequent fall in price may have been due to some extent to the announcement that Soya beans are to be on the United Kingdom "free list" as regards Tariff proposals.

The Singapore average prices in February were:- Sundried, $6.62; Mixed, $6.15 per picul as compared with $5.73 and $5.20 respectively in January.

Copra cake was quoted in Singapore at $2.20 per picul throughout the month.

Coconut Oil.—The average wholesale export price of coconut oil in Singapore for the month of February was $11 per picul.

Gambier.—No. 1 Cube gambier averaged $20 per picul on the Singapore market, while the average nominal price of Block gambier was $13.12 per picul.

Rice.—The average declared trade value in January of imports of rice of all sorts was $4.23 per picul, as compared with $4.24 in December.

The retail market prices in cents for gantang of No. 2 Siam rice in January were:—Singapore 32, Penang 38, Malacca 27, as compared with 32, 36 and 26 respectively in December last.

Arecanuts.—During February, Palambangs averaged $3.62 per picul in Singapore as compared with $3.88 in January. Bila Whole averaged $3.76 against $3.97 in January. For other grades the average prices in February were:—Split, $4.37 to $5.79; Sliced, $8.37 to $12.62; Red Whole, $7.44 to $8.31—all per picul, the price within each range depending upon quality.

Coffee.—Prices for both Java Robusta and Palambang have ruled high owing to a good demand for the Bombay market. The average price of Palembang in

February was $15.69 per picul as compared with $17.75 in January. Java Robusta averaged from $22.75 to $24 per picul in February, the price within these limits depending upon quality.

Pineapples.—Singapore prices firmed, but prices in London for the forward positions are below canners' ideas. Towards the end of the month prices eased in anticipation of the summer "pack" which commences in March. Average Singapore prices per case in February were :—1½ lb. cubes, $3.89; 1½ lb. sliced flat, $3.57½; 1½ lb. sliced tall, $3.80, as compared with $3.92, $3.80 and $3.69 respectively in January.

Tapioca.—Average prices per picul for February were :—Flake fair, $3.14; Pearl, seed, $4.44; Pearl, medium, $4.46; as compared with $3.20, $4.45 and $4.70 respectively in January.

Sago.—There was improved interest by both European and Eastern buyers, resulting in better prices. The demand, however, eased off at the end of the month. The following are the average Singapore prices per picul in February :—Pearl, small, fair, $4.37½; Flour, Sarawak, fair, $2.70. Corresponding prices in January were $4.42 and $2.72 per picul.

Nutmegs.—Singapore prices remained fairly steady throughout February. Average prices per picul for the month were :—110 per lb., $28; 80 per lb., $31.75 as compared with $27.30 and $30.40 respectively in January.

Mace.—Average Singapore prices per picul in February were :—Siouw, $59.75; Amboina, $46.75.

Pepper.—London stocks showed a considerable increase of pepper shipped to "optional" ports, probably due to heavy landings prior to the imposition of duty. Average Singapore prices per picul in February were :—Singapore Black, $23.87½; Singapore White, $30.87½; Muntok White, $31.50 as compared with $23.50, $30.70 and $31.70 respectively in January.

Cloves.—Prices have been nominal and unchanged in Singapore at Zanzibar $48 and Amboina $50 per picul.

The above prices are based on London and Singapore quotations for rubber; on the Singapore Chamber of Commerce Reports published in February and on other local sources of information. Palm Oil Reports are kindly supplied by Messrs. Cumberbatch & Co., Ltd., Kuala Lumpur; reports on the Singapore prices for Coffee and Arecanuts by the Lianqui Trading Company of Singapore, and a report on the coconut oil market by the Ho Hong Oil Mills, Singapore.

1 picul = 133⅓ lbs. The dollar is fixed at two shillings and four pence.

NOTE.—The Department of Agriculture will be pleased to assist planters in finding a market for agricultural products. Similar assistance is also offered by the Malayan Information Agency, 57, Charing Cross, London, S.W.1.

GENERAL RICE SUMMARY.

January, 1932.

Malaya.—Gross foreign imports of rice during January 1932 amounted 51,021 tons as compared with 69,300 tons for the same month last year, of which 61.1 per cent. were consigned to Singapore, 15 per cent. to Penang, 7.2 per cent. to Malacca, 15.4 per cent. to the Federated Malay States and 1.3 per cent. to the Unfederated Malay States.

Of these imports 56.3 per cent. were from Siam, 42.5 per cent. from Burma, 0.5 per cent. from French Indo-China and 0.7 per cent. from other countries.

Total foreign exports of rice in Januray 1932 were 16,684 tons, of which 83 per cent. went to the Netherlands East Indies.

The area and production of rice in Malaya for the season 1930—31 was 707,686 acres and 259,735 tons, respectively, as compared with 657,198 acres and 154,318 tons 1929—30, increases of 7.7 per cent. and 68.3 per cent. The season 1929—30 was marked by drought, while the following crop was a good one.

The padi reports indicate that work for the current season 1931—32 is in hand in all areas and harvesting in progress in places, notably in Perlis and Kedah. Crop prospects in Perlis are said to be excellent.

India.—Total foreign exports of milled rice during November 1931 were 135,000 tons an increase of 25,000, or 22.7 per cent. over November 1930.

From January to November, 1931, the total foreign exports of milled rice were 1,941,000 tons a decrease of 21.7 per cent. as compared with the corresponding period of 1930, and a decrease of 8.9 per cent. as compared with the corresponding period of the past six years.

The Fourth Forecast of the Rice Crop in Burma for the season 1931—32 gives the area likely to mature as 12,019,400 acres, being 4.6 per cent. less than the final figures of last year. The unusually dry November and general lateness in sowing and transplanting is responsible for a decrease of 71,000 acres in the area estimated to have matured.

Burma exports of rice and rice products (including exports to India) from January 1st to December 26th, 1931, were 3,498,124 tons as compared with 3,421,574 tons for the same period of the previous year, or an increase of 76,550 tons (2.2 per cent.).

Siam.—Exports of rice from Bangkok for December 1931 were 116,016 tons, an increase of 41 per cent. as compared with December 1930 and an increase of 9.4 per cent. as compared with the December average for the previous five years.

The Second Forecast of the 1931 Rice Crop states that the area planted in the Seven Inner Circles at the end of December 1931 amounted to 4,480,000 acres, being 140,000 (3 per cent.) less than the final figures of 1930. The area to be harvested is placed at 3,720,000 acres and the damaged area at 760,000 acres. The yield is estimated at 2,214,000 tons of padi and the amount available for

METEOROLOGICAL SUMMARY, MALAYA, JANUARY, 1932.

Locality	Air Temperature in degrees Fahrenheit							Earth Temperature		Rainfall								Bright Sunshine		
	Means of			Absolute Extremes						Total		Most in a day	Number of days					Total	Daily Mean	Per cent
	A. Max.	B. Min.	Mean of A and B	Highest Max.	Lowest Min.	Lowest Max.	Highest Min.	At 1 foot	At 4 feet				Precipitation* .01 in or more	Precipitation, .05 in or more	Thunder-storm	Fog morning obs	Gale force 8 or more			
	°F	°F	°F	°F	°F	°F	°F	°F	°F	in.	mm.	in.						hr.	hr.	%
Railway Hill, Kuala Lumpur, Selangor ...	88.5	70.0	79.3	94	67	79	73	82.1	83.0	4.96	126.0	1.80	11	11	2			214.55	6.92	57
Bukit Jeram, Selangor ...	87.1	71.0	79.0	89	68	82	73	83.2	84.7	4.91	124.7	2.38	10	8		1		233.00	7.52	63
Sitiawan, Perak ...	88.7	69.9	79.3	91	67	82	74	82.4	83.2	6.27	159.3	2.12	13	9	3	1		238.05	7.68	65
Kroh, Perak ...	84.4	67.2	75.8	89	64	77	71	78.4	80.2	0.88	22.3	0.40	7	5				252.35	8.14	69
Temerloh, Pahang ...	84.0	69.6	76.8	88	64	75	74	80.6	82.9	7.45	189.2	3.43	19	13		3		159.70	5.15	33
Kuala Lipis, Pahang ...	83.8	69.1	76.5	88	65	78	72	80.3	81.8	8.99	228.3	4.48	18	18		13		147.05	4.74	39
Kuala Pahang, Pahang ...	82.3	74.5	78.4	83	71	80	77	80.1	81.3	4.32	109.7	1.08	25	17				155.50	5.02	42
Mount Faber, Singapore ...	84.9	71.9	78.4	90	67	79	74	78.9	80.7	6.52	165.6	1.65	15	12				176.70	5.70	47
Butterworth, Province Wellesley ...	88.7	71.5	80.1	93	68	84	74	82.2	83.9	0.87	22.1	0.47	5	4				265.00	8.55	72
Bukit China, Malacca ...	85.0	72.0	78.5	89	70	74	74	79.9	81.7	2.99	76.0	1.19	9	7				223.30	7.20	60
Kluang, Johore ...	83.3	71.1	77.2	89	67	75	73	78.8	80.5	8.03	204.0	2.71	14	11				168.00	5.42	45
Bukit Lalang, Mersing, Johore	80.4	73.6	77.0	82	71	78	76	77.4	78.9	7.25	184.2	1.84	20	15				131.20	4.23	35
Alor Star, Kedah ...	88.5	69.0	78.7	92	65	84	75	81.3	83.8	0.06	1.5	0.05	2	1				278.95	9.00	76
Kota Bahru, Kelantan ...	82.2	70.3	76.3	85	65	79	75	79.2	81.7	1.52	41.2	0.31	12	10				171.50	5.53	47
Kuala Trengganu, Trengganu	82.0	71.5	76.7	84	68	77	75	78.9	80.5	3.24	87.8	0.34	20	18				167.40	5.40	45
HILL STATIONS.																				
Cameron Highlands, Rhodendron Hill, Pahang 5120 ft. ...	68.0	56.3	62.1	73	53	65	60			5.61	142.5	2.34	16	11		2	6	169.05	5.45	46
Cameron Highlands, Tanah Rata, Pahang 4750 ft. ...	69.0	56.1	62.5	72	45	66	62	67.3	67.9	5.30	134.6	2.41	16	14		7		167.90	5.42	45
Fraser's Hill, Pahang 4268 ft.	66.5	59.0	62.7	73	55	63	63	67.6	68.8	10.39	263.9	2.10	19	18		29	3	109.30	3.53	30

Compiled from Returns supplied by the Meteorological Branch, Malaya.